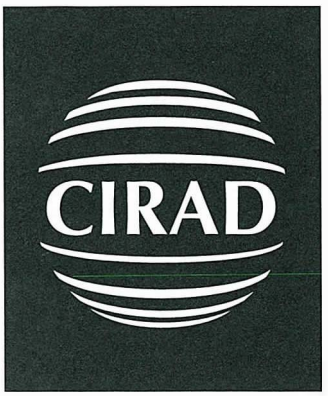
Ministry of Agriculture
Food Crops and Horticulture
General Directorate
Jakarta – Indonesia

Ministère des Affaires Etrangères
Direction des Affaires Culturelles
Scientifiques et Techniques
Paris – France



THE SOYBEAN COMMODITY AND SEED MULTIPLICATION SYSTEM IN INDONESIA

Mission report and proposals

Robert SCHILLING
May 2000

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SUMMARY

AGENDA

➢ Mon. Oct. 18 : - Arrival in Jakarta.

➢ Tue. " 19 : - Working session at the General Directorate for Food Crops.
- Visit to Bogor.

➢ Wed. " 20 : - Flight to Padang.
- Working session at the Provincial Extension Service.
- Visits to the Seed Certification and Control (SCC) labs and to private seed companies (P.T. Pertanian and Sang Hyang Sri).

➢ Thu. " 21 : - Visit of Muoro District : local representatives of Extension Services, farmers, tahu processors.

➢ Fri. " 22 : - Visit of Muoro area.

➢ Sat. " 23 : - Visit to private seed retailers and a groundnut processor in Padang.
- Meeting with the Chief Extension Service Officer of Sawah Lunto Sijunggung area.

➢ Sun. " 24 : - Flight to Jakarta.

➢ Mon. " 25 : - Flight to Surabaya
- Visit to Provincial Extension Service.
- Visit to Tejo Main Seed Farm, P.T. Pertanian Seed Company, and farmers in Jombang.

➢ Tue. " 26 ; - Visit to Nganjuk Extension Service, Sang Hyang Sri seed processing unit, farmers in the district.

➢ Wed. " 27 : - Working session in Malang with soybean scientists of the Oil Crops and Tubers Research Institute.
- Visits to District Seed Farm (Malang) and Provincial Seed Farm (Badawi-Lawang).
- Visit to the Japanese soybean Project (JICA).

➢ Thu. " 28 : - Visit to East-Java Provincial Extension Service.
- Flight to Ujang-Pandang.
- Visit to South-Sulawesi Provincial Extension Service.

➢ Fri. " 29 : - Visit to Assessment Institute for Technical Agriculture (BPTP) and Provincial Seed Certification Service.
- Visit to SHS Seed Company.

➢ Sat. " 30 : - Visit to District Extension Service in Bantaeng.
- Visit to Provincial Seed Farm in Batukaropa (Bulukumba District) and farmers.

➢ Sun. " 31 : - Visit to Soeppeng District Extension Service.

➢ Mon. Nov. 1 : - Visit to Provincial Extension Service in Ujang-Pandang.
- Flight to Jakarta
- Phone appointment with Guyomard Animal Feed Factory.

➢ Tue. " 2 : - Debriefing session at Planning and Programming Directorate.
- Return flight.

1-The soybean commodity and seed multiplication system in Indonesia : Report background and outline

1.1 : Introduction

An agronomist from the Center of International Cooperation in Agronomic Research for Development (CIRAD, France), specialist of tropical oil and protein annual crops, had made a survey of the soybean commodity system in Indonesia in December 1998. Seed production and distribution was identified as a major constraint to crop development.

A second mission was undertaken in October 1999, by the same consultant, in order to investigate further the seed production system in the socio-economic and agronomic background of the crop. An overview of the groundnut situation was included on request of the General Directorate for Food Crops. The provisional report was presented in December and approval was received in February 2000. The present report was achieved with the significant contribution of Marie-Hélène DABAT, economist, and substancial help and guidance from Ir. SARLISTYANINGSIH, from Planning and Programming Directorate of Food Crops and Horticulture DG.

1.2 : Acknowledgements

Our mission was efficiently organized by the CIRAD Representative and his staff; efficient as well as friendly guidance was provided all along the trip by Mrs Sarlistyaningsih.

The Director General of Food Crops, Dr. Chairil A. Rasahan, as well as the Director of Planning and Programming Mr Napitupulu, gave us useful guidelines and advice for the fulfilment of our mission. We are grateful to Mrs Nasmiyati Nazar, representing the provincial E.S. Director in west Sumatera, to M. Suvono, representing the Provincial E.S. Director in East-Java, to M. Sjamsuri, Provincial E.S. Director in South Sulawesi, to all their staff and in particular to those who guided us in the 3 Provinces, for their constant help.

Our thanks are extended to the scientists and researchers (Drs. Naris Saleh, Virologist and Octri Director ; Darman, breeder ; Sania Saenong, BPTP Directress) who helped us in the scientific aspects of the soybean problem. Mr Daniel, from the Palawija Section of the Seed Development Directorate, and Mrs Marta Sulaksmi, from the Planning and Programming Directorate, accompanied us in South Sulawesi and contributed efficiently to the enquiry.

We are grateful to the French Ministry of Foreign Affairs (MAE) for their financial support and attention to our proposals.

1.3 : Report outline

Three Provinces, with diverse characteristics regarding soybean production and more particularly the seed issue, have been visited : West Sumatera, East Java and South Sulawesi. Meetings were held with local, provincial and national officials ; visits were made to institutional as well as private operators of the soybean seed system, to soybean producers, to processors of tahu, tempeh, animal feed, and to research scientists and extension officers.

There is certainly a major coordination problem between the participants in the seed production system, belonging to three groups :

- The institutional network of State Farms multiplying breeder seed provided by Research, under technical supervision of Seed Control and Certification Services (SCCS).

- Private companies processing and selling seed, in relation with State Farms, seed-grower groups and traders, under control of SCCS.

- The soybean farmers themselves, producing, selling and exchanging seed from one season or area to another, through the traditional JABAL system which accounts for over 95 % of the seed capital.

The economic issue is determinant in the feasability of crop intensification, including the use of certified seed : it appears that the small farmer cannot afford improved soybean seed at commercial cost, considering the low monetary return resulting from competition between national and imported product, added to the fact that there is no awareness of any constant superiority of certified seed as compared to jabal seed.

Soybean seed is bulky, fragile and short-lived. Processing and storage are not properly mastered, making it almost impossible under prevailing conditions to keep seed from one growing season to the other. A number of technical problems can be listed :

- Poor production capacity of certified seed, beginning with breeder seed from research stations, and inadequate coordination between operators of the successive generations of seed production.

- Lack of involvement of breeders in seed production, and more generally of research scientists in the practical issues linked with the seed sector : adaptive research in small mechanization, post-harvest technology, packaging, storage and quality control.

- Poor access to innovation and low investment capacity of the farmer added to lack of incentives for quality improvement of the crop, resulting in varietal mixtures, low maturity, high moisture content, high percentage of foreign material, acid and cracked grains.

- Priority given to other crops and to intensive cropping patterns (2/3 crops /year), resulting in preference for rustic, early maturing soybean varieties rather than high-yielding, late maturing types.

- Local varieties and production not meeting processors' demand, for reasons of price and convenience (easy and cheap availability of imported soybean) as well as technical preferences (colour, shape, size, extraction rate allegedly better with imported soybean).

The seed sector cannot be dissociated from the soybean commodity channel as a whole. There is no progress possible without overall improvement of yield, quality and financial return. **There is no evidence that use of commercial seed as provided today in Indonesia will result in significantly higher monetary returns.** The absence of convincing research results or reliable statistics relevant to this aspects may well explain the fact that all attempts towards large scale production and distribution of commercial seed answering international certification standards have not met the expected results.

On-farm or JABAL seed production capacity of the Indonesian farmer has been neglected, with much unfruitful attention given by previous projects to the institutional system. An efficient soybean seed organization would require good coordination between a State-controlled institution in charge of sustaining seed quality and a deconcentrated network of seed growers producing bulk seed.

Off-season multiplication in the same area, when possible, and on-farm storage facilities, should be encouraged and improved, rather than costly transfer from one area to another. It is proposed that the seed-farms network be reenforced in order to produce soybean seed of good quality as scheduled by a genealogical multiplication scheme. This certified material would be delivered to seed-grower groups operating within the jabal system with yearly renewal of one-third of their seed capital and encouragement to direct on-farm seed production.

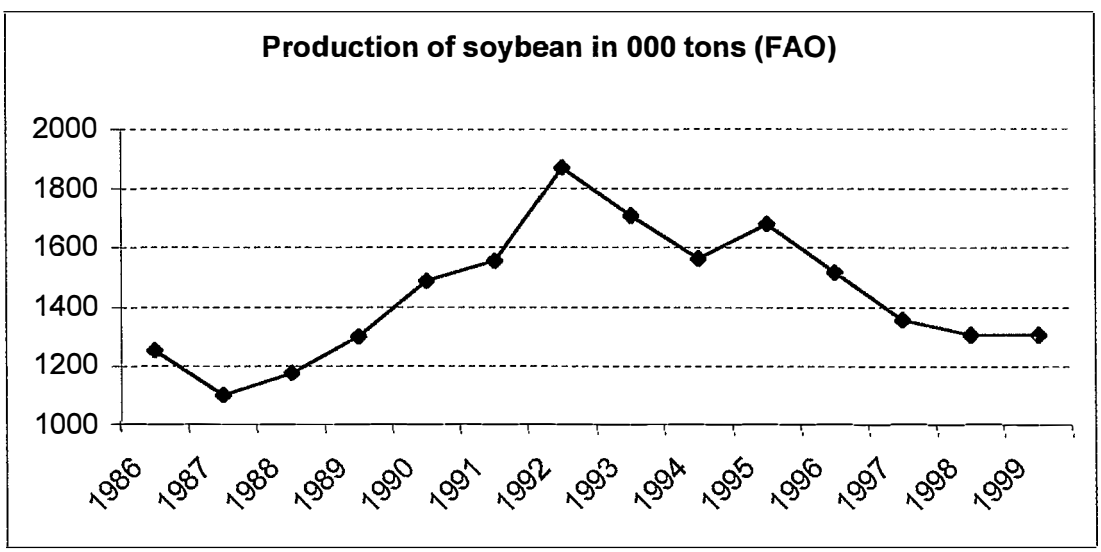
2- Economic analysis of the soybean commodity channel in Indonesia

March 2000
Marie-Hélène Dabat

2.1 : Introduction: growing demand in spite of the economic crisis

Soybean is a secondary crop in Indonesia, which is in direct competition with maize, groundnut and mung bean as a dry season crop in rice-growing zones or as an upland crop during the rainy season. It is solely used for small-scale production of goods intended for human consumption. Yields—at 1.2 t/ha on average—are low in relation to international standards due to the adverse production conditions[1].

Demand for soybean is growing very fast, given the role played by the crop in the human diet (10-11 kg per capita per year, on average, one of the highest consumption levels in Asia)[2] and the population growth rate in the country. Demand jumped from 1.7 Mt in 1989 to 2.2. Mt in 1998/99 (ie a 30% increase in a decade). However, national output, which reached 1.9 Mt per year between 1989 and 1992 but was still unable to meet demand, subsequently fell back to just 1.3 Mt in 1998/99. Moreover, by 2010, demand looks likely to reach 2.8 Mt (NASUTION, 1990) or even 4.9 Mt (World Bank, 1992) depending on the different hypotheses put forward.



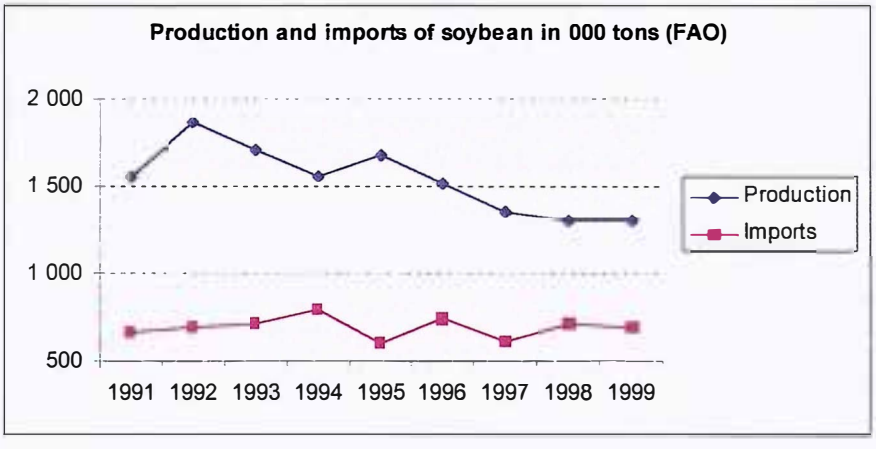
[1] Tropical conditions, constraints such as insect pests and diseases.
[2] With higher levels in Java and rapidly growing levels elsewhere in the country. In 1997, consumption in rural areas was running at 4.5 kg of tempe and 4 kg of tahu; and in urban areas, 6.5 kg of tempe and 7 kg of tahu.

The improvement in output in the late 1980s and early 1990s stemmed from the Indonesian government's implementation of a soybean development programme intended to make the country self-sufficient. The initial aim was to have a planted area of over 1.7 Mha, so as to increase output by 700 000 t and achieve the 2.2 Mt required to feed the population in 2000. Despite continued efforts[3], results have fallen well short of the target.

According to several observers and in no particular order, soybean cultivation comes up against the following constraints: quality seed supply problems (low output of seed farms, insufficient productivity and punctuality, unsuitable quality and varieties), limited access to credit, increasing agricultural input costs, later returns on investment than with other crops, the fact that soybean is not a priority for planters in relation to rice, non-guaranteed prices.

In the late 1990s, the situation worsened as the country was hit by a severe drought and financial crisis which both had devastating effects on the agricultural economy[4] and on food supplies for the population. The crisis led to a drastic fall in production, a substantial currency devaluation, an increase in food prices, and a significant drop in purchasing power leading to a fall in consumption, particularly amongst low-income groups, despite increasing requirements in quantity terms.

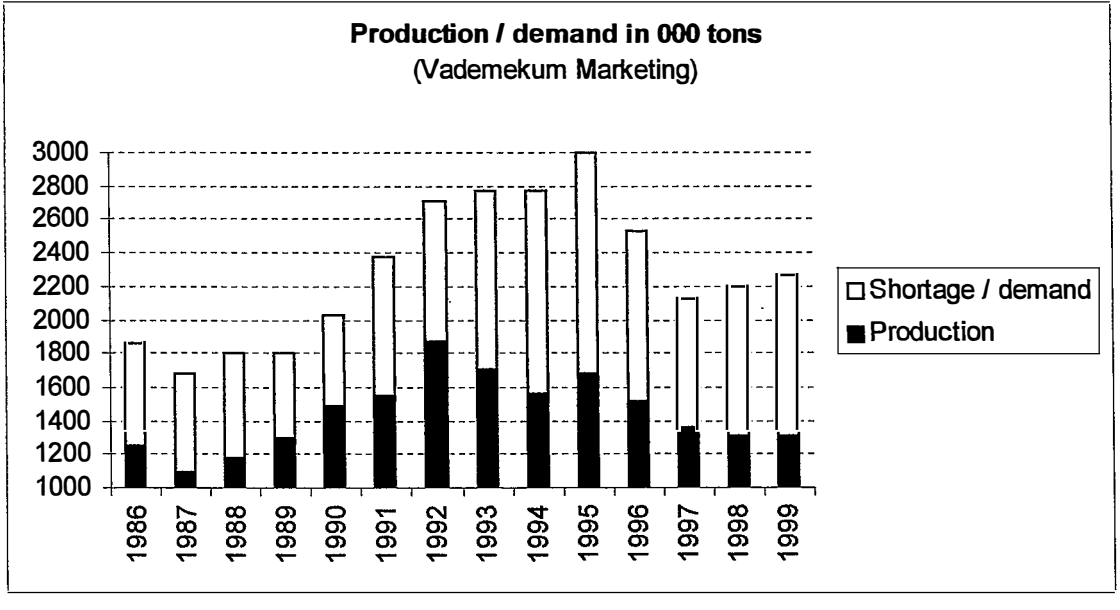
However, unlike other agricultural products such as groundnut, national soybean consumption fell relatively little despite the economic crisis and the 60% increase between 1997 and 1998 in the price of the two soybean-based agrifood products: *tempeh* and *tahu*. Reduced buying amongst low-income groups was partly cancelled out by the switch amongst the middle classes from meat and poultry, the price of which increased considerably, to soybean products. Imports thus partly compensated for the fall in output over the period.



[3] In 1998, a government initiative set out to extend the planted area by increasing crop rotations (rice-rice-soybean rather than rice-rice-fallow) in selected provinces, including West Java, Central Java, North Sumatera, Jambi, South Kalimantan and East NT Tengarra). The efforts under way include an extension programme centring on technical improvements (seeds, fertilizers, management, occasional irrigation) and operations to encourage cultivation in zones chosen for transmigration from Java (target of 103 000 ha), including supplying inputs to planters and guaranteeing market prices.

[4] And soybean in particular : reduction in planted area and yields, as a major share of soybean is grown in non-irrigated zones during the dry season.

A 1990 report[5] distinguished between three phases in the history of soybean in Indonesia over the previous 20 years: an *initial phase* (up to 1975) during which the country was self-sufficient and both production and consumption were low; a *second phase* (1975-1985) during which the increase in demand outstripped that in supply, leading to domestic price inflation as imports were limited; and a *third phase* (after 1985) during which production increased more as a result of transmigration than of intensification as the possibilities of extension were limited in Java. The country apparently entered a *fourth phase* in 1992, marked by the substitution of imports for domestic products. The 1997 economic crisis and climatic events account for the low production since then, but there are more structural reasons for the fall in output from 1993 onwards.



2.2 : The political context: from food self-sufficiency to managing the economic crisis

Indonesia has long opted to protect domestic production, primarily of food crops[6] Although the country undertook in 1985 to open its markets (by encouraging exports and cutting import duty), the World Bank calculated in 1992 that over half of the total food crop harvest still benefited from non-tariff trade barriers.

[5] Wiebe Franck S. / The soybean economy of Indonesia: a discussion of the strategy of self-sufficiency / August 1990.

[6] Increased intervention in agricultural markets on the part of the authorities from the mid-1970s onwards has nevertheless gone well beyond the food crops sector, since it has also concerned crude palm oil (CPO), with the constitution of a buffer stock.

The State exerted close control over the rice market, the dominant product in the Indonesian agrifood system, which plays a fundamental role in the self-sufficiency policy that has been implemented since the 1970s and is still in force today. This protection has long been tolerated by those in favour of free agricultural markets, in particular since the increased productivity achieved in terms of rice growing offset the cost of such self-sufficiency policies.

The country still sees rice self-sufficiency as a priority, since one of the latest aims announced by the government is to cease rice imports in 2001 (Public Ledger, November 1999). The aim is to increase domestic production from 49 to 51-52 Mt in 2000. Programmes and measures are being implemented to improve water supplies to rice paddies in Java. Imports were due to be cut back to 1.5 Mt in 1999, after the all-time high of 1998 (from 4.8 to 6 Mt depending on the source), but were actually around 3.6 Mt (provisional figure). Public-sector imports were limited to 1.9 Mt, but private-sector imports were higher than expected. There is talk of imposing import duty on rice, which has already had certain perverse effects: to forestall the measure, rice importers apparently bought in large quantities in late 1999. The State has just decided to force private operators to import only top quality rice (5% broken grains or better).

The past few years have thus been marked by increasing difficulties in achieving food self-sufficiency (rapid population growth, limited possibilities of extending rice growing), despite the programmes implemented in the 1980s to increase rice production and diversify crops. The Indonesian government was keen to develop secondary crops so as to make more effective use of land not suitable for irrigated rice, and above all to reduce food imports. This move was combined with a public information campaign aimed at encouraging the population to diversify its diet.

Like other products[7] , soybean benefited for some time from State protection (State monopoly on imports from 1983 onwards, maintenance of trade barriers), whereas the crop represented just 5% of total agricultural production in value terms at the start of the 1990s and the national interests that had to be protected were thus limited. The restrictions on meal imports were virtually lifted in 1993 (the cost of protection was higher than the profits made by crushers), but the public monopoly on soybean seed imports was not abolished until August 1997.

However, the State is continuing to play a crucial role through the BULOG (the national logistics bureau) in terms of soybean imports, despite the IMF agreement at the start of 1998 that was intended to bring an end to all monopolies on any products other than rice. The State channel is currently the only way of importing essential products into Indonesia at a preferential exchange rate[8] . The products covered by the

[7] Like rice, wheat, sugar and garlic. Imports of maize, the country's second largest food crop in terms of the area planted and harvest value, were liberalized in 1989. This measure was warranted by the strong growth in demand from livestock farmers and animal feed manufacturers that could not be met by the domestic sector, and was made possible by the good performance of Indonesian producers who did not suffer as a result of the move. In this case, the question is more one of maize production for food purposes, which demolishes the self-sufficiency argument quoted for other crops.

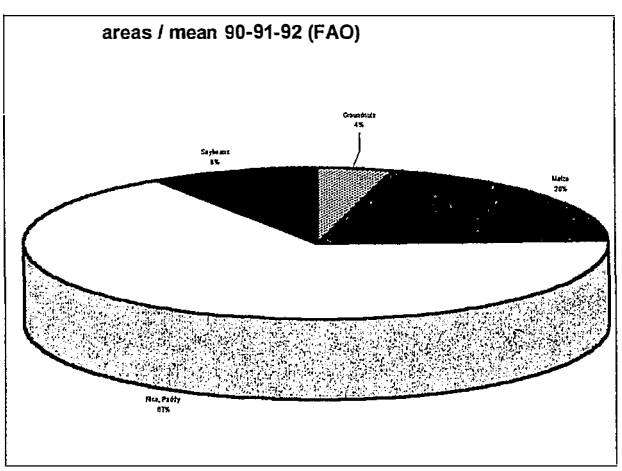
[8] Rp 6 000 for US$ 1 rather than the market rate of Rp 8 to 15 000.

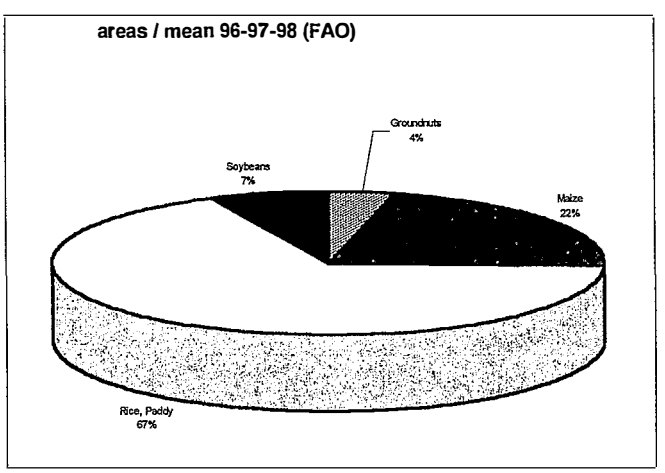
measure include rice, wheat, maize, sugar, and soybean seed and meal. Moreover, rice and soybean, as staples, are temporarily being subsidized by the State so as to limit price rises due to the drought and the devaluation of the rupiah. Private importers are allowed to buy soybean abroad, but as they do not benefit from these advantages, they cannot compete with the State monopoly.

2.3 : Trends for the main secondary crops to rice: cereals and oil crops

Indonesia, the world's fourth most populated country, produces almost 50 Mt of paddy rice, ie 8.8 % of the world total. Rice largely dominates secondary food crops such as maize (around 10 Mt), soybean and groundnut (some 1 Mt each).

A comparison of the distribution of areas between the main four crops in competition at the start (1990-91-92 mean) and end (1996-97-98 mean) of the decade does not show any significant differences. However, soybean fell back a little, from 9 to 7 % of the total area, with maize gaining 2 %. The main crop, rice, maintained its 67 % share of the total area under these crops, and groundnut 4 %. The area occupied by the crops as a whole increased by 5.8 % in eight years.



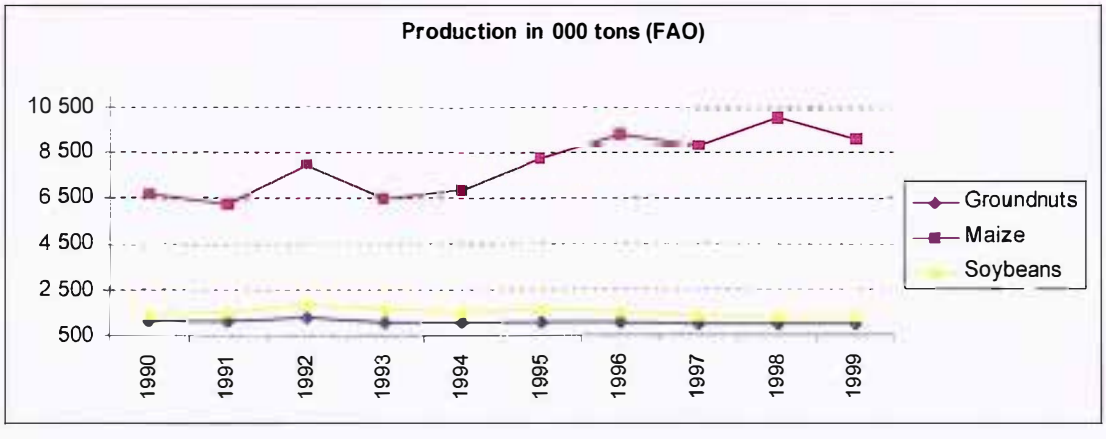


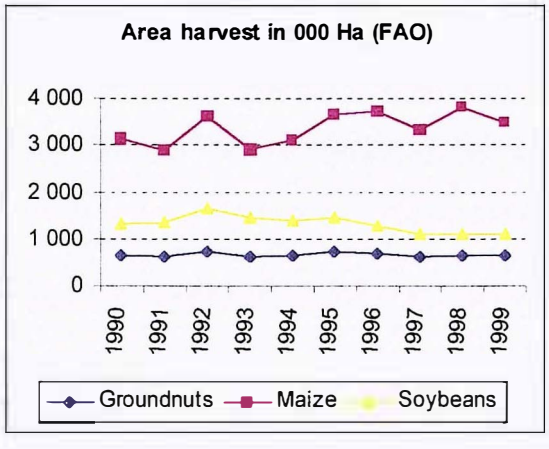
The increase in the area planted with maize and the growth in maize yields, from 2.1 to 2.6 t/ha, have enabled an over 30% increase in annual output over the past ten years.

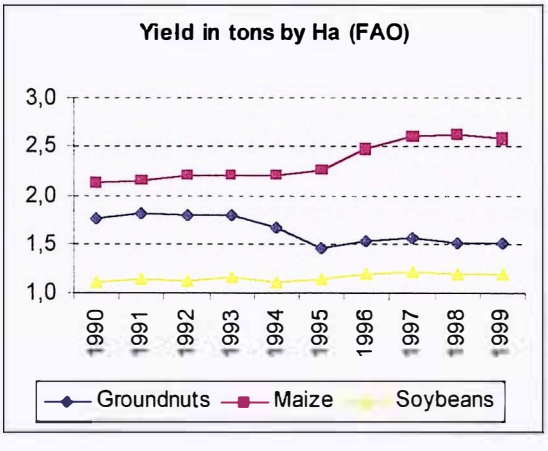
Despite the stability of the areas planted with groundnut, output in the country fell between 1990 and 1999 (-13.5%), partly due to falling yields. The fall in production can also be put down to poor sales as a result of a sharp price increase, reaching Rp 7-8 000/kg in 1998 compared to Rp 5 000 at the start of 1998 and Rp 2 500-2 700 in 1997 (a threefold increase in a year). Future groundnut production trends will depend

on the relative price of the product, but also on climatic conditions, land availability and growers' cropping strategies. In terms of the area used, the current priority for most growers is rice, followed by maize and soybean, although the price of these crops has also increased.

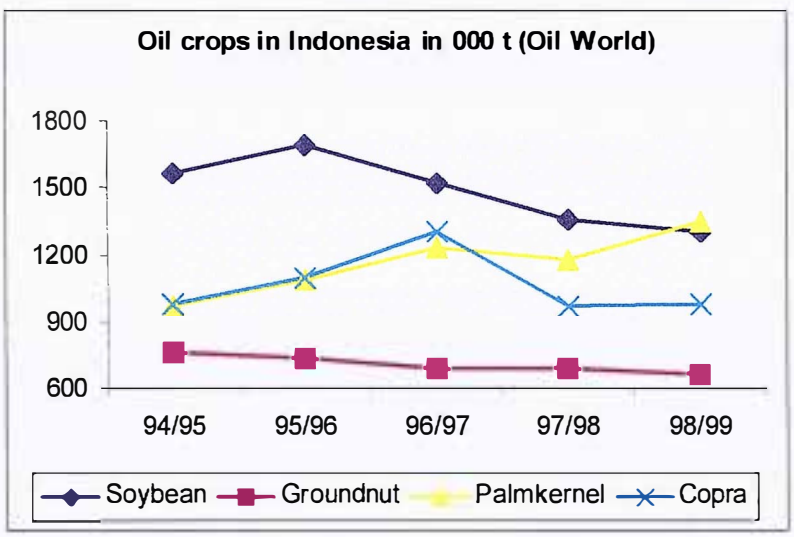
The drop in soybean production between 1990 and 1999 (-12.2%), linked to a reduction in the area planted with the crop (-18.3%) following an increase in the mid-1990s, was partly counteracted by a slight increase in yields.







In volume terms, soybean is no longer leader among commodities categorized as "oil crops". Oil palm production outstripped that of coconut in 1996/1997 and that of soybean in 1998/99, with the soybean and coconut figures falling for different reasons (a reduction in area for soybean and falling yields for coconut). Oil palm is indeed the only oil crop for which output is increasing in Indonesia. However, these other oil crops are not secondary to rice and are not intended to satisfy the population's food requirements.



2.4 : External agricultural product exchanges

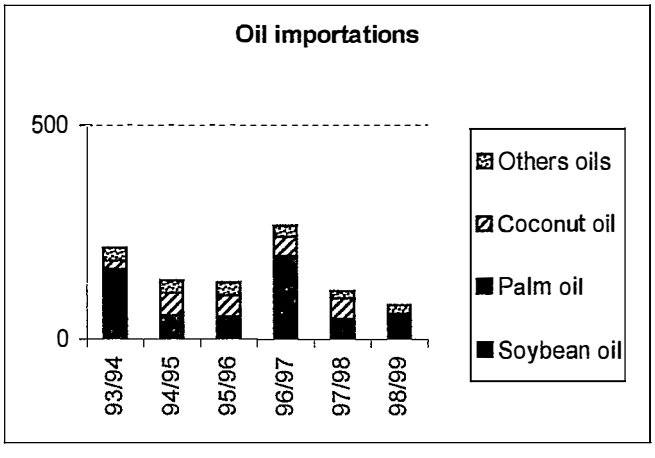
Record rice imports

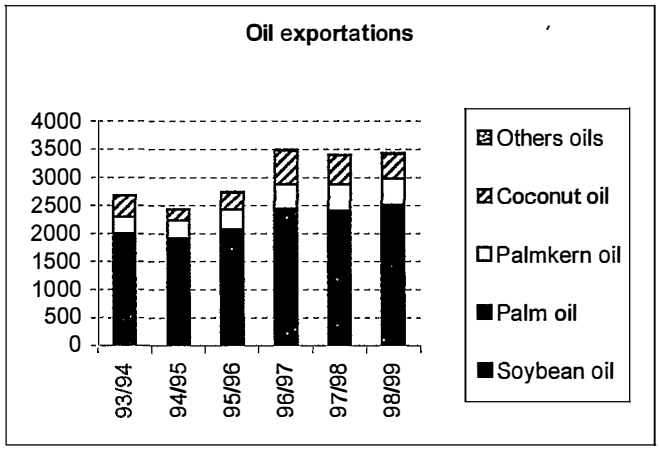
The very poor paddy harvests in 1997/98 worsened the shortfall in several Asian countries. Indonesia, the leading rice importer, increased its imports sixfold in 1998 with over 6 Mt, the equivalent of 13% of what it produced and a quarter of total world imports (a level that had never before been reached by a single country). In 1999, despite a marked drop in imports, Indonesia's foreign rice requirements were still high at around 3.5 Mt. The share of imports in total rice resources varies substantially. It depends on domestic production, which is in turn closely linked to climatic conditions, particularly water supply. Maize imports also vary substantially, exceeding 1 Mt some years (for instance 1994 and 1997) despite the strong increase in domestic production.

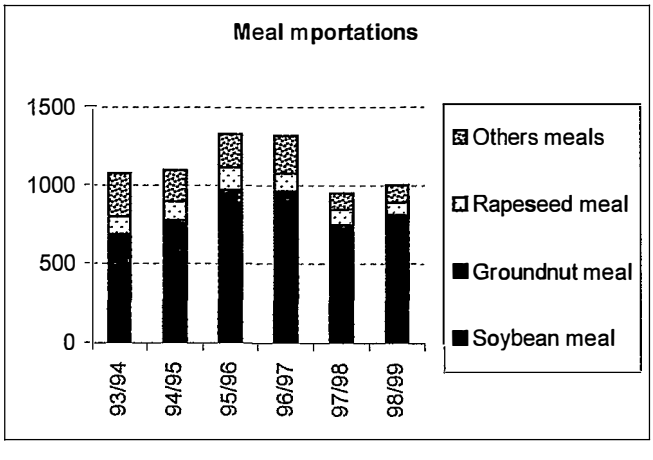
Oil crop trading

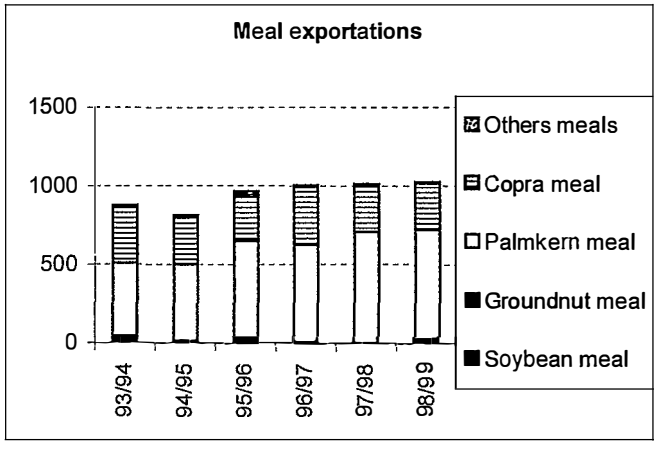
Whereas almost all the Indonesian oil palm and coconut crop is crushed and imports of these two products are negligible, domestic soybean and groundnut output is insufficient, and apart from variations in stock levels, all of the available soybean (domestic production and imports) and almost all the groundnut is used to make food products. The country imports the equivalent of around 60% of its soybean needs (between 600 and 800 000 t) and 8 to 23% depending on the year (over the last five observation years) of its groundnut crop (anything up to 170 000 t).

Commercial oil crop exchanges with other countries in 000 t (Oil World)









Import and export meal exchanges are roughly equivalent (around 1 Mt in each direction), with a downward trend in terms of imports and a rise in exports, for the reasons already mentioned. Soybean dominates meal imports, whilst exports primarily concern palm and coconut.

Indonesia exports more oil (between 2.5 and 3.5 Mt) than it imports (under 300 000 t). Palm oil plays a crucial role in its foreign trade balance, with a very substantial commercial excess.

Soybean imports

Soybean purchases overseas rose considerably in 1996 and 97 due to the relaxing of import restrictions[9], with a return to the 1995 situation in 1998, ie annual imports of almost 700 000 t.

Commercial soybean trading with other countries (in 000 t)

	1991	1992	1993	1994	1995	1996	1997	1998
Seed imports	673	699	724	801	607	746	616	724
Oil imports	-	-	-	1	3	11	49	12
Meal imports	193	171	361	499	682	942	869	668 (1)
Seed exports	-	-	108	-	-	-	-	-
Oil exports				26	9	-	28	-
Meal exports				46	4	12	4	5

(1) USDA put soybean meal imports at 430 000 t in 97/98 Source: Oil World

Imported soybean meal has gradually replaced domestically produced meal. The increased cost of imports following the devaluation of the rupiah, which trebled the price of meal between 1996 and 98, drove up chicken prices and resulted in lower consumption[10]. This poultry sector crisis reduced demand from poultry farmers for imported meal (the forecasts of 700 000 t were cut to 450 000 t a few months previously). The economic crisis severely affected the animal production sector and indirectly resulted in surplus production capacity in the animal feeds industry. The State recently (1999) exonerated producers of animal feeds and the corresponding ingredients from VAT (10%), in the interests of poultry farmers.

The poultry industry is now picking up, prompting stakeholders to import meal (900 000 t in 1998/99) so as to build stocks pending the elections at the end of the year. Maize imports for storage have also increased (415 000 t in 1998/99). Those integrated feed manufacturing/livestock rearing firms and livestock farms that survived the crisis are back in profit (USDA).

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[9] It is important to note that this measure was implemented in April 1996, ie before the economic crisis. The increase in meal imports primarily benefited the major animal feed production plants.

[10] Poultry consumption apparently fell from 1 Mt to 470 000 t between 1996/97 and 1997/98, whilst meal imports fell from 1.1 Mt to 350 000 t (USDA).

The effects of the financial crisis on the human food product sector made themselves felt more slowly (60% of demand is satisfied by local output or BULOG stocks), which did not prevent the soybean seed price from doubling in 1998 compared to 1997 and 96, notably due to middlemen anticipating on the exhaustion of stocks. This doubling of the price is now being passed on to processed product prices, which have been up 50 to 100% since February 1998 in relation to the 1997 averages. 1998/99 and 1999/00 soybean imports look likely to top 1 Mt (all from the USA).

The main soybean suppliers

The USA have gradually taken over from China as the main soybean supplier: China accounted for 60% of imports in 1994 and the USA 32%, whereas the latter accounted for 98% in 1998. This is a result of the easy terms granted by the USA to encourage American soybean sales to those Southeast Asian countries hit by the financial crisis (extension of the repayment period from one year to three).

Although low, overseas soybean oil purchases increased over the period. The main suppliers are Brazil, Malaysia and Argentina.

The main soybean meal supplier is India (54% of 1998 imports), with increasing volumes, followed by Brazil and Argentina (17% and 14% respectively), which are losing ground, and the USA (11% in 1998), which have managed to increase their share through the easy repayment conditions mentioned above. The USA are much less well placed in terms of soybean meal than in terms of seed, as this market is much more price-sensitive.

Soybean by-product exports are low and somewhat sporadic: there are no established trade links with any particular country.

External trade prospects for soybean

The prospects for external trade development over the next three to five years depend on the speed with which Indonesia's economic and financial situation is able to recover. Volumes will depend on national policy, the rupiah/US$ exchange rate , and international soybean prices in relation to local rates. Unless domestic output progresses, American soybean imports are likely to increase, as the product is a major source of proteins for the Indonesian population.

Meal imports were estimated at 520 000 t in 1998/99. The level of future imports will depend on how the local animal production sector develops. As a result of the crisis, many consumers have switched from chicken to «tofu» and «tempe», which are cheap sources of protein. Imports have also been boosted by the gap between domestic and world market prices. If world rates remain competitive, imports could increase even further.

Moreover, the Americans consider that soybean-based foodstuffs manufacturing is one of the agrifood industries most worth investing in in Indonesia (liberalization of the rules covering establishment, creation of the AFTA zone which will increase opportunities in the ASEAN, etc).

Groundnut imports

For groundnut, the main external trade flows concern peanuts and meal, both of which are expanding rapidly. Indonesia has traditionally been a major peanut importer: 157 000 t in 1998, ie over 10% of the 1.3 Mt traded worldwide (see CIRAD product sheet (fiche produit)). It is one of the least demanding importing countries in terms of sanitary criteria, at least compared to Europe, the leading importer.

Groundnut imports have apparently ground to an almost total halt since early 1998 as a direct result of the economic crisis, but this would seem to be only temporary. However, the significant fall in Indonesian groundnut meal imports (-71%) as a result of the Asian economic crisis looks more structural and long-lasting. 1998 and 99 imports were estimated at 50 000 t, well below the figure of 240 000 t before the crisis, despite domestic output being down (935 000 t in 1998 and 99).
Amongst peanut suppliers, India has largely replaced Vietnam and China over the past five years. In 1994, Vietnam supplied 51% of Indonesian imports, China 30% and India 13%. India's share grew to 84% in 1997 and 71% in 1998. India is also practically the sole groundnut meal supplier. These Asian countries are highly competitive in relation to the USA, as the groundnut market is very price-sensitive; they benefit from their proximity to Indonesia, which enables them to cut transport costs and ship variable volumes.

2-5 : World markets for rice and secondary crops

The main market indicators for the four products concerned are given in an appended table based on the relevant CIRAD product sheets (fiches produits). The main qualitative characteristics and production and trade growth prospects are covered below.

Groundnut

World groundnut production increased substantially during the 1990s, primarily due to an increase in the area planted. Growth stabilized in Asia, the main producer, and North and Central America. It fell in Latin America due to competition from soybean, although Argentina extended the area planted with groundnut. The highest growth rate was in Africa (+45% in 10 years), in small producing countries (RSA, Zimbabwe, Malawi, etc), to the detriment of the leading exporters such as Sudan (civil war) and Senegal (State withdrawal).

Domestic consumption in producing countries is very high, particularly compared with that of soybean. The market has generally shrunk in recent years. However, the peanut market is relatively dynamic, with a 5% annual growth rate and a doubling of trade between 1984 and 94 despite competition from maize-based products. Expert opinion is divided as to the prospects for world trade growth, due to the inability of certain exporting countries to adhere to the increased quality standards laid down by developed consumer countries (aflatoxin), the reduced purchasing power of the former Eastern bloc countries, the temporary slowing of Indonesian imports and the increase in domestic demand in certain Asian countries.

As regards groundnut oil, the fall in supplies from traditional exporting countries for various reasons has hindered trade development. However, demand has remained high due to the properties of the product, despite its higher cost compared to other oils and competition from olive oil, the only oil that is more expensive, in southern European countries. The groundnut meal market, on the other hand, has been hit hard by the Asian economic crisis over the past three years, and particularly by the drop in Indonesian and Thai imports. However, demand in Europe is stable.
Like those of other oil crops, groundnut and groundnut by-product prices have fallen in recent years. This is particularly true for peanuts and groundnut oil.

Soybean

Oil and meal are the main outlets for soybean (over 90 % of world output is crushed). However, the main use in Asia is still the manufacture of a wide range of human food products.
Soybean occupies a central position on the world oil crops market. Meal is also highly important. Soybean oil, however, is faced with competition from palm and rapeseed oils.
The USA dominate seed exchanges, while oil and meal supplies are much more geographically diversified. Asian meal consumption increased from 14 Mt in 1992 to over 24 Mt in 1998, ie more than in the EU and the USA. The oil market is marked by a growth in Chinese imports.
World soybean production has grown considerably since the early 1990s due to the increase in areas in Brazil and the USA and improved yields in Argentina. The seed market has been stimulated by increased Brazilian exports and Chinese imports, while the oil and meal market has been boosted by increased crushing capacity in Argentina, which is now the world's leading exporter of these products. However, demand in Asia has fallen due to the recent economic crisis, which limited the purchasing power of meat consumers. This slowing down was counteracted by imports by the EU, North Africa and the Middle East, but demand is likely to remain limited, which will help to maintain the current low soybean meal price levels. Demand for oil should be more sustained, but is unlikely to lead to a price increase, due to the recovery of Indonesian palm oil, which is dragging prices down.

Rice

World rice production fell by around 3 % in 1998. Severe flooding affected the harvest in numerous Asian countries, particularly the main three producers: China, India and Indonesia. The crop was also smaller than usual in other countries worldwide (persistent drought in Latin America, drought and a shortage of inputs in Nigeria, a reduction in the area planted in Egypt, insect attacks in Madagascar, etc). World trade was thus over 40 % up in 1998, reaching a record 27.5 Mt compared to 19 Mt in 1997. Strong demand from Asia largely contributed to this increase, which was unprecedented in the history of rice trading. Overall Asian imports were 85 % up, particularly in Indonesia, to compensate for the fall in output due to repeated adverse climatic conditions (drought, flooding, etc). This increase in demand did not lead to a world price boom like the one seen in 1993/94 as a result of massive imports by Japan, as China and India had substantial stocks. In 1999, the good Asian crop contributed to a substantial fall in worldwide demand.

Over the past decade or so, international rice prices have been falling due to increased supply on the export market. In 1998, despite increased demand, price pressure was low as a result of the large volumes available in exporting countries. In 1998 as a whole, world prices fell compared to 1997. This trend looks likely to continue throughout 1999, in view of the recovery of Asian production. Production growth should result in world trade growth, albeit subject to currency availability in low-income importing countries.

Maize

On a worldwide level, maize production growth is losing steam due to a slowing down of yields. However, Asian production growth is still strong, notably in China, Indonesia and Thailand.

Competition on the world market picked up in the 1990s as a result of the high excess production capacity of traditional exporters (USA, Argentina) and intermittent Chinese surpluses. Prices have been at a stable, low level since the start of the 1990s. The presence of Argentina as a confirmed exporter and increased production in China should ensure slightly increased supplies. Demand should be almost constant in the coming years. Stocks, which are running at 15 % of consumption for maize and a little less for other cereals, should grow still further. The 1995/97 price increase was apparently just a blip in the ongoing downward trend.

The main trends point to increased use of maize worldwide. Animal feed requirements are the main driving force behind demand and international maize exchanges, and it is thus primarily in emerging Latin American and Asian countries that the best prospects for growth in demand are to be found.

The strong competition between traditional exporters, who are increasing supplies to depressed traditional import markets (Asia) should nevertheless keep prices down.

2.6 : The new economic context: the search for profitable production strategies for farmers

By upsetting the relative advantages of various products and between domestically produced and imported products, liberalization, even though it is not yet complete, and the devaluation of the rupiah have contributed to an upheaval of the rules of the economy and their effects on farmer strategies and financial results.

The abnormal rise in rice prices in late 1994 reflected the tense market situation, which the State was unable to cushion due to its insufficient stocks. It is clear that the continuing tension on the rice market (exceptional imports in 1998) is pushing growers to increase rice production to the detriment of secondary crops, provided weather conditions allow.

However, soybean has the advantage of being less dependent on water supply than rice. In the most productive systems, growers are reluctant to take the risk of embarking on a second rice cycle and have decided to plant shorter-cycle, less demanding crops such as soybean, maize, groundnut or mung beans. Soybean is also less input-intensive than rice and thus less sensitive to increases in the cost of imported phytosanitary products.

Maize, which competes with soybean in cropping systems, could seem to be less worthwhile for Indonesian growers in view of the increasing demand for soybean. However, it has the advantage that it can be exported at a price made more attractive by the devaluation of the rupiah.

Nevertheless, although rice is dependent on water supply and maize is becoming less economically worthwhile, soybean still represents a high economic and agronomic risk in relation to rice and maize. Soybean supply is also more widely scattered than that of rice in the archipelago, whilst demand centres on Java, making transport costs higher than for rice.

The fact that Indonesia's self-sufficiency in terms of rice is now in doubt is proof that the drive to modernize irrigated rice growing and the profits for growers may have reached their limit. It highlights the importance for increasing agricultural income of the new change in Indonesian agriculture that is taking place in response to changing domestic and international demand. However, the development of markets such as that for fruit and vegetables is still some way away from generating similar levels of income to those provided by rice growing or other annual crops. There is thus considerable uncertainty as to how to improve farmer incomes in relation to other professional groups.

Where does soybean stand in relation to other crops?

2.7 : The economic results of soybean growing in Indonesia

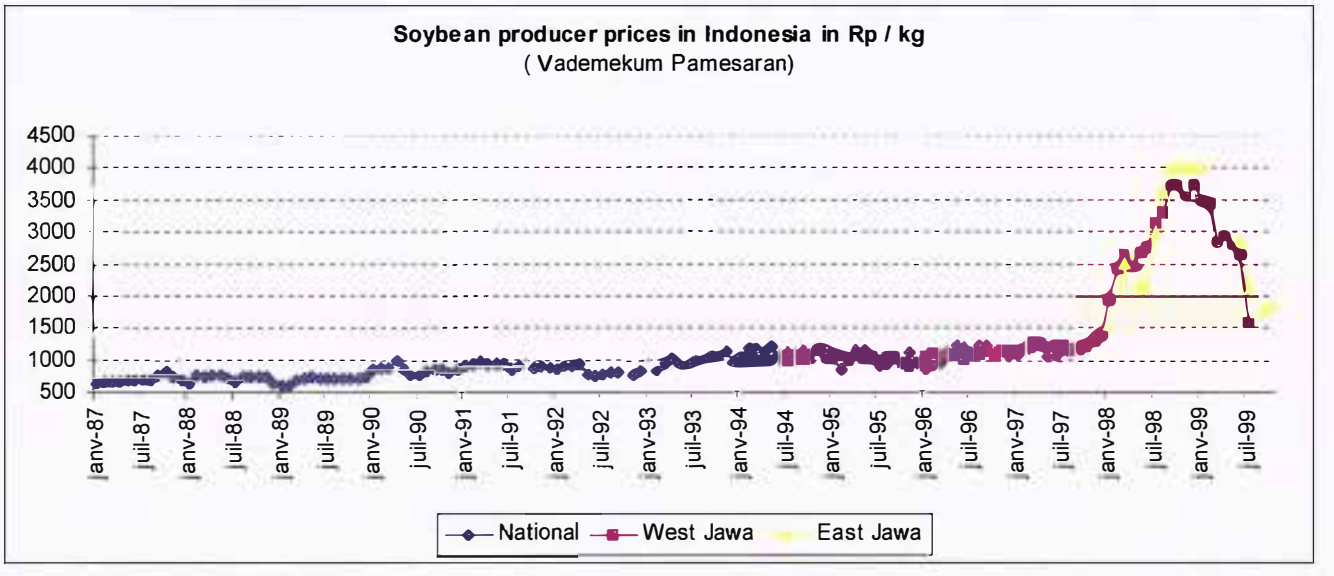
The micro-economic information gathered from various sources during the mission was used to establish typical operating accounts for 1999 with a view to estimating the current profitability of soybean growing. The figures correspond to production conditions in West Java (Jatim), which accounts for some 40% of Indonesian output.

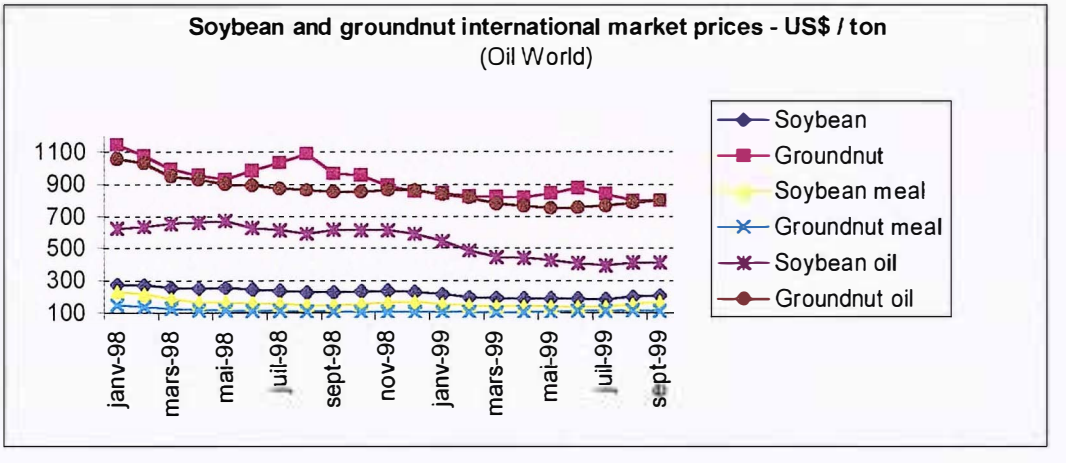
Income per hectare varies between Rp 400 000 and 1 300 000 in East Java, depending on whether family labour and land rental costs are included. The average income for Indonesia as a whole was Rp 1 800 000 in 1998 (before deducting family labour and land rental costs), at the time of the exceptional soybean price boom. The return to a more normal price situation (fall from Rp 4 000 to 1 700/kg between 1998 and 1999), particularly as a result of competition from imports, made the profitability of soybean growing less certain, with the cost-benefit ratio falling below one.

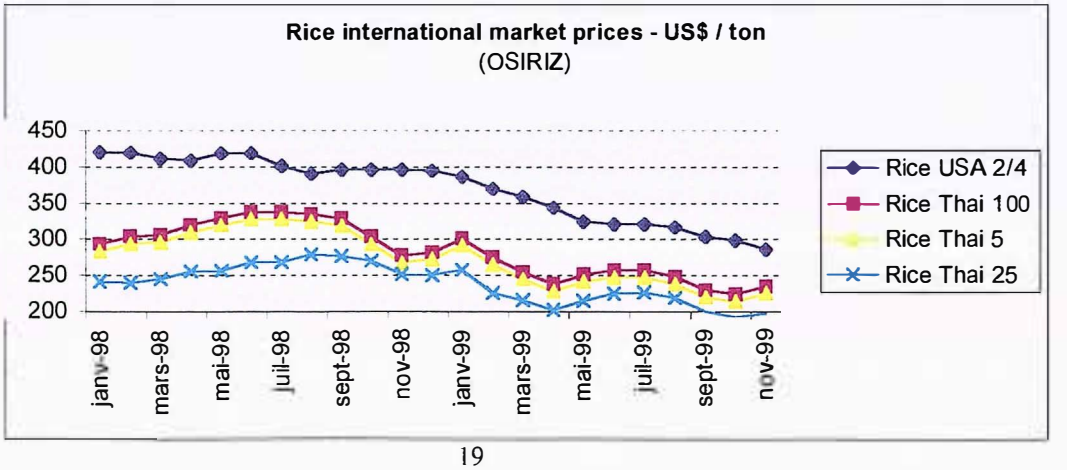
Operating accounts per hectare in 1999 for East Java

			Hired labour	Family labour	Total
COSTS					
Labour	Pre-harvest	Cultivation	90 000	18 000	108 000
		Planting	149 000	9 000	158 000
		Fertilization	9 000	18 000	27 000
		Weeding	167 000	26 000	193 000
		Crop protection	36 000	18 000	54 000
		Watering	0	126 000	126 000
	Post-harvest	Harvesting	162 000	18 000	180 000
		Cleaning	32 000	16 000	48 000
		Transport	54 000	9 000	63 000
		Drying	36 000	9 000	45 000
		Threshing	71 250	0	71 250
Total labour			**80 6 25 0**	**267 000**	**1 073 250**
	Inputs	Seed	-	-	140 000
		Fertilizer	-	-	200 000
Total inputs			-	-	**340 000**
Other costs		Land rental	-	600 000	600 000
		Land tax	-	-	28 000
		Farmer group contributions	-	-	12 000
		Ceremonies	-	-	50 000
Total other costs			-	-	**690 000**
Total costs			-	-	**2 103 250**
OUTPUT					
Production			1 500 kg		
Price			Rp 1 700		
Total output					Rp 2 550 000
Income of farmer (with family labour)					Rp 446 750
Income of farmer (without family labour and land rental)					Rp 1 313 750
C-B ratio (with family labour)					0.21
C-B ratio (without family labour and land rental)					0.62

Indonesian soybean sales prices have been higher than import prices since the State lost its monopoly on imports (Public Ledger). In 1998, the selling price per kg of Indonesian soybean fluctuated between Rp 1 500 and 4 000. Assuming a mean of Rp 3 000 and a non-subsidized exchange rate of Rp 10 000 = US$ 1, Indonesian soybean sold for the equivalent of US$ 0.30/kg or US$ 300/t whereas the international soybean price at the time was around US$ 200.







2.8 : Production systems and economic results per province

The role of soybean in production systems

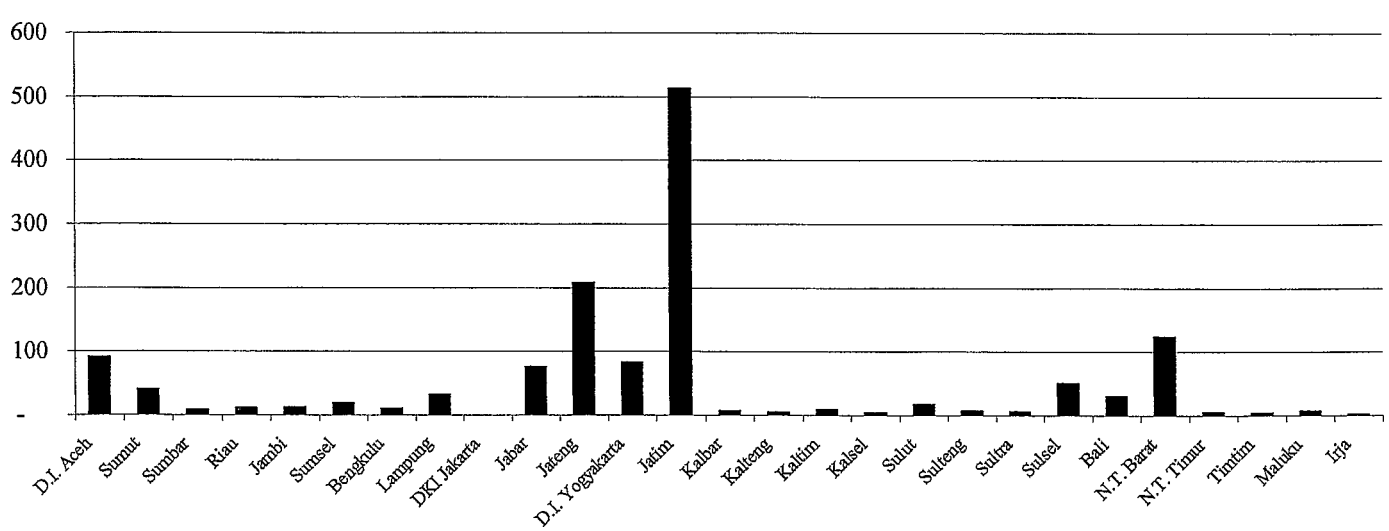
80% of Indonesian soybean is produced in Java.

Production in the different provinces in 1997

Islands		Provinces	Production (t)	Islands		Provinces	Production (t)
Sumatra	**1**	**DI Aceh**	**90 517**	Borneo	14	Kalbar	5 629
	2	Sumut	39 303		15	Kalteng	4 075
	3	Sumbar	7 156		16	Kaltim	8 274
	4	Riau	10 094		17	Kalsel	2 560
	5	Jambi	11 213	Celebes	18	Sulut	16 177
	6	Sumsel	18 151		19	Sulteng	5 626
	7	Bengkulu	8 809		20	Sultra	5 052
	8	Lampung	31 914		21	Sulsel	50 111
	9	DKI Jakarta	0		22	Bali	29 443
Java	**10**	**Jabar**	**75 239**		**23**	**NT Barat**	**122 345**
	11	**Jateng**	**207 019**		24	NT Timur	4 452
	12	**DI Yogyakarta**	**82 347**		25	Timtim	2 695
	13	**Jatim**	**511 531**		26	Maluku	6 376
					27	Irja	783
					Total Indonesia		**1 093 293**

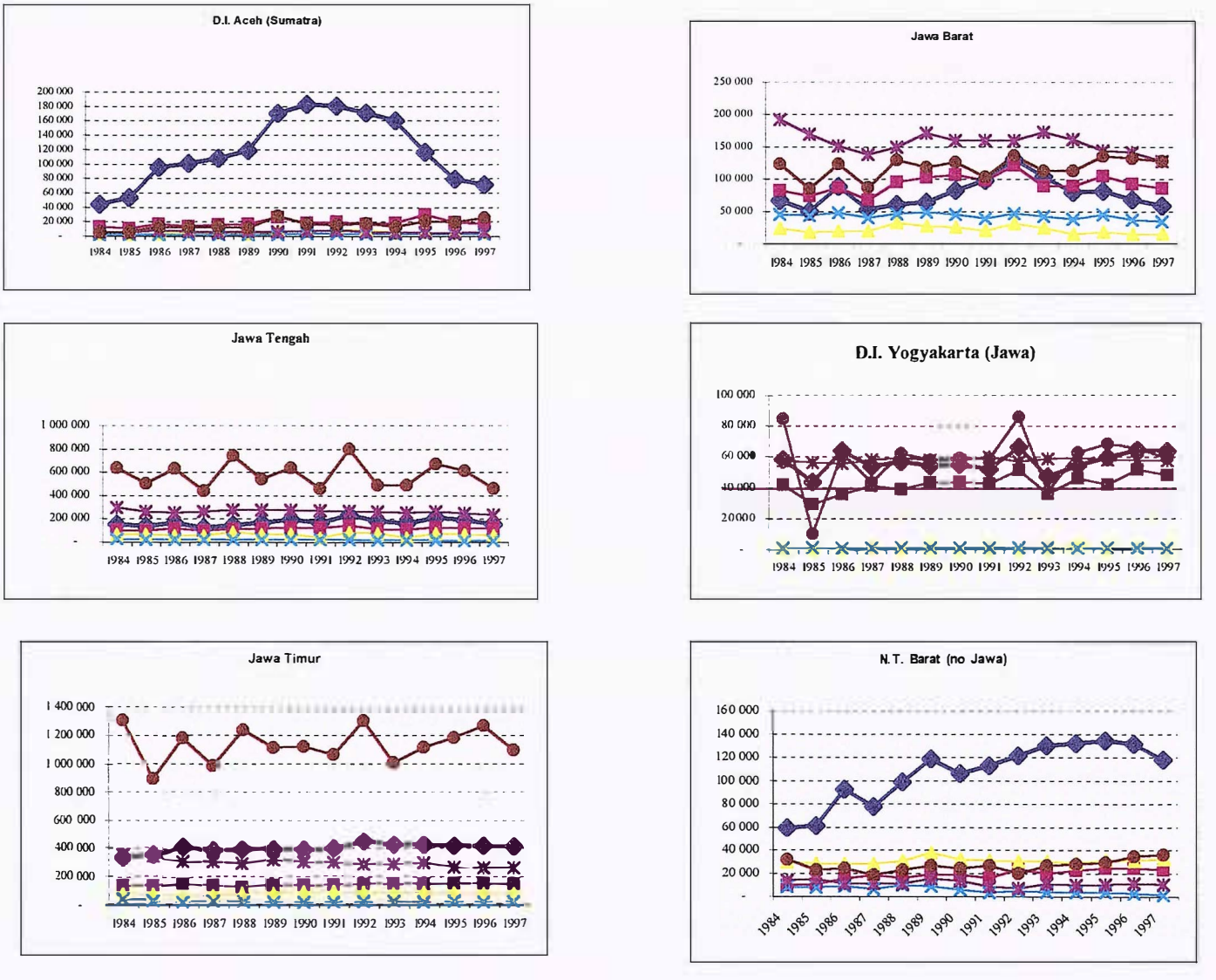
Of the six provinces that produce the most soybean, four are in Java. It was in these provinces that we compared the position of soybean with that of other crops recommended for diversification.

Soybean production in tons by province in 1997
(Vademekun Pamesaran)



The position of soybean in production systems varies from province to province. Of the most productive provinces, the two outside Java (DI Aceh in the far West of Sumatra and NT Barat to the East of Java) have chosen soybean as the main diversification crop. This is not the case in Java, where a distinction can be made between the provinces in which maize is dominant (Jawa Tengah ie Central Java and Jawa Timur ie East Java) and those where «polycultures» are practised (Jawa Barat ie West Java; Yogyakarta ie Central Java), where there is no dominant crop in terms of the area planted over the period 1984-1998. The main crop in terms of tonnage in these provinces is cassava. Maize and cassava are dominant in tonnage terms in Central and East Java. Given the drop in soybean production in the two regions where it is dominant in terms of area and the varying yields depending on the crop, the difference seen in area terms is less marked in production terms.

Areas of diversification crops per leading soybean-producing province
(in hectares). Source: Vademekun Pamesaran 1987-1997



The disparity of economic results depending on the provinces

Although the operating accounts used were not very recent (they dated back to 1992/93)[11], they enabled a comparative analysis of operating results per province, which revealed substantial disparity.

Depending on the province, yields varied between 0.6 and 1.9 t/ha. The highest yields were not seen in the provinces in Java, although yields there were higher than average. The best figures (over 1.5 t) were recorded in a province in Sumatra (Sumut) and another in Borneo (Kaltim).

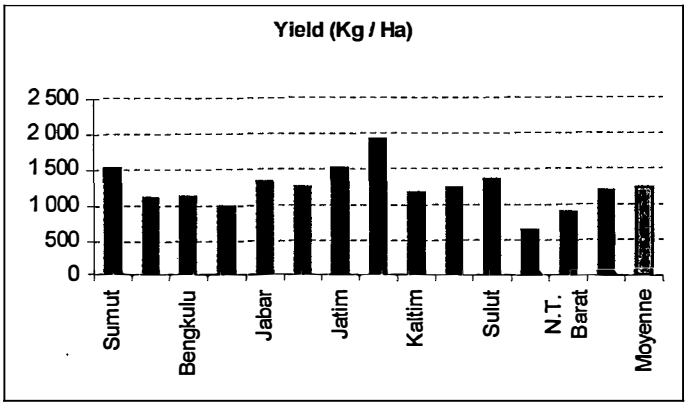
Soybean selling price variations were less marked than yield variations. Prices were slightly higher in the provinces in Java and Borneo than in those in Sumatra and particularly in the Celebes, which were well below average. The strong demand for soybean in Java may account for this higher price pressure. Production costs were also higher in Java than in the other provinces, although on the island itself, the highest costs were seen in East Java, which is, as mentioned above, the province that produces the most soybean in Indonesia. Costs were also relatively high in Timor.

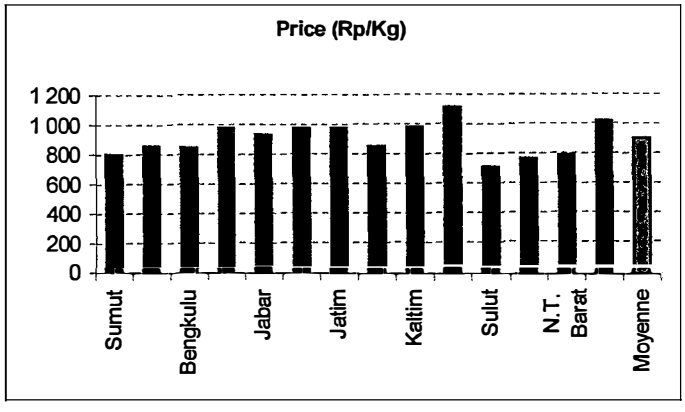
All in all, the highest incomes per hectare were seen in Borneo, particularly in Kalbar province, which has the dual advantage of high yields and relatively low production costs, despite a slightly lower than average selling price. It is also worth noting the good performances of Sumut province (Sumatra) and Sulut (Celebes) in terms of cost-benefit ratio. It is thus clear that the provinces in Java, particularly the most productive (Jatim and Jateng) performed below the Indonesian average, primarily due to high production costs.

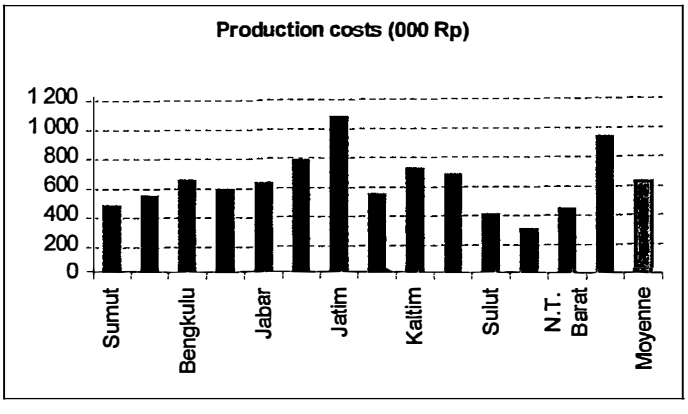
[11] Moreover, information was not available for all 27 Indonesian provinces. Of the provinces that produce large volumes of soybean, those missing included DI Aceh (Sumatra), DI Jogyakarta (Java). East and Central Java, the most productive provinces in the country, were represented, however.

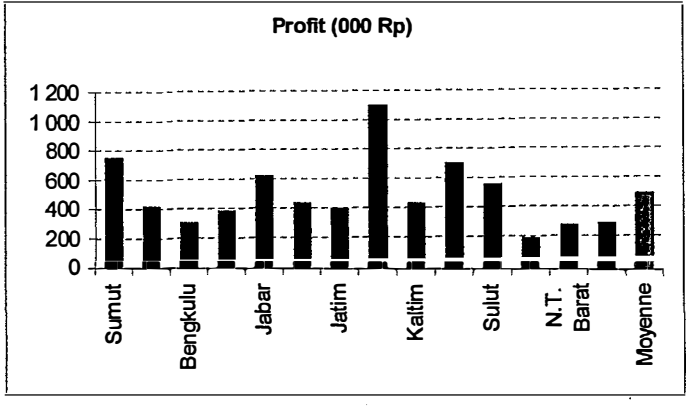
Comparison of the main profitability variables per province in 1992-93

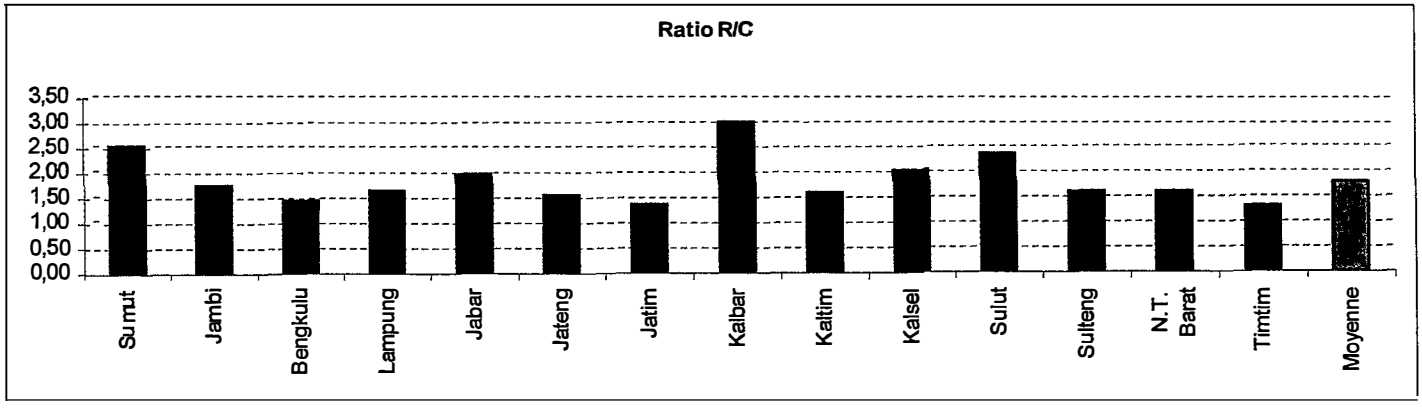
(figures per hectare). Source: Vademekun Pamesaran 1987-1997







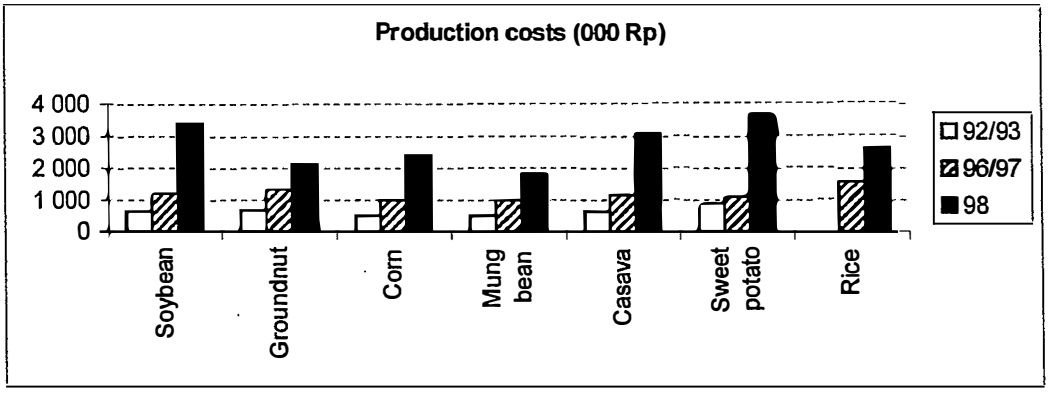


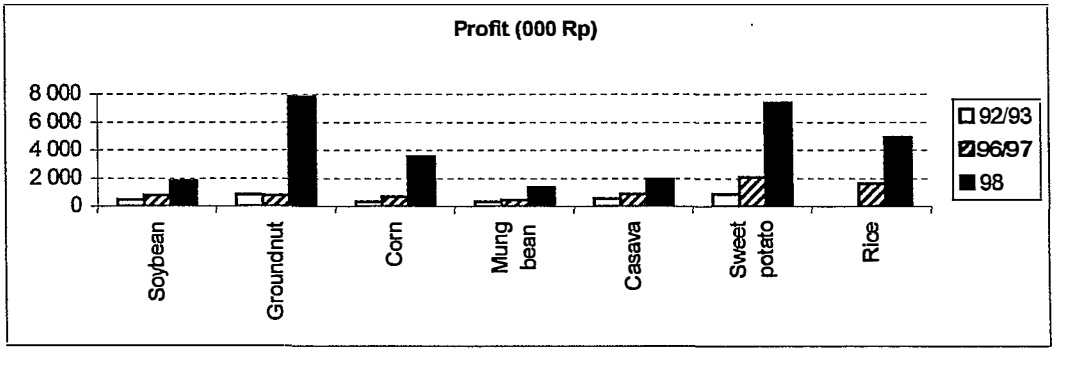


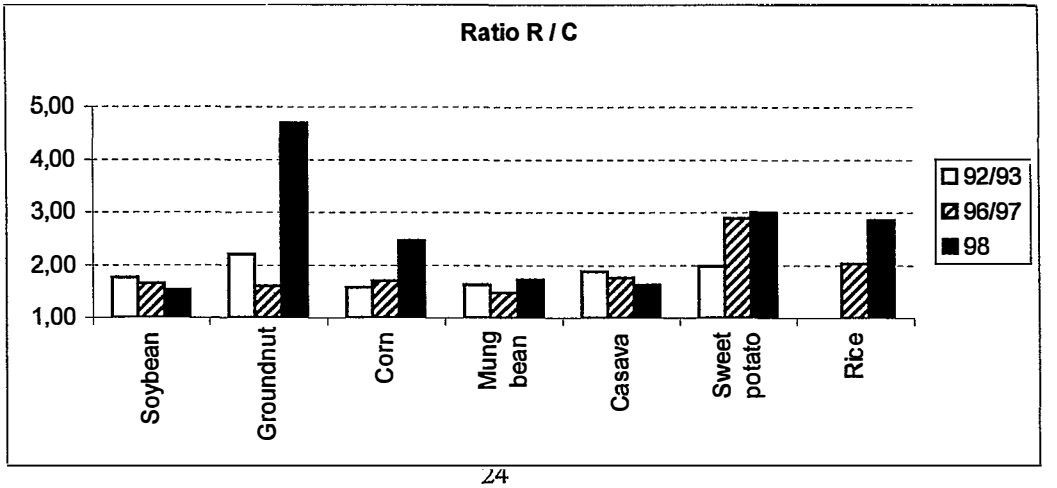
2.9 : Comparison of economic results for diversification crops

A look at the operating results over a period including the effects of the devaluation of the Indonesian rupiah shows that the relative position of the different crops has changed. Soybean is the crop for which production costs increased the most between 1992/93 and 1998, despite the small proportion of imported inputs required. Only sweet potato entailed higher costs than soybean, which were partly counteracted by a substantial increase in the income derived from it. The cost-benefit ratio for groundnut improved significantly between these two dates, putting it top of the list of diversification crops in 1998. Rather than being due to a limited increase in costs, this trend can be put down to a considerable increase in income per hectare, which in turn can be attributed to an increase in relative prices, since groundnut yields stagnated or even fell back towards the end of the period. However, the ratio decreased for soybean (and also cassava), since production costs increased proportionally more than income per hectare, placing soybean in the least favourable position in relation to other crops.

Trends for the main profitability variables per crop
(figures per hectare). Source: Vademekun Pamesaran 1987-1997







2.10 : Conclusion

The combination of State withdrawal, trade liberalization and the fall in international prices in the 1990s cast doubt on the self-sufficiency policy on which agricultural policy as a whole had centred for several decades. These changes led to a fall in domestic production and an increase in Indonesia's dependence on the world market for soybean supplies which proved difficult to reduce in volume terms.

The financial and economic crisis which has hit a large part of Asia since the end of the decade has led to increased intervention by the Indonesian State, which now facilitates soybean imports so as to maintain consumption by its population. This new factor has further clouded the true comparative advantages of Indonesian staples, particularly soybean, in relation to imports.

The financial performance of soybean growing has worsened recently, prompting growers to turn to other secondary crops (notably maize). The advantages of soybean have decreased in relation to imports, which are currently facilitated by the State given soybean's role in the Indonesian diet, but also in relation to other diversification crops. Unless Indonesian soybean productivity increases significantly, imports should logically continue to replace domestic output in the light of both trade liberalization and, even more importantly, the need to secure food supply.

Annex 1: Comparative summary of the trends for certain world market indicators (based on 1999 CIRAD product sheets) **Annex 1: Comparative summary of the trends for certain world market indicators (based on 1999 CIRAD product sheets)**

	Rice	Maize	Soybean	Groundnut
Worldwide area	Roughly 150 Mha	137 Mha in 98	70 Mha	23.8 Mha in 98
Worldwide production	Paddy: 570 Mt in 98 Processed rice: 370 Mt	592 Mt in 98/99	Seed: 157.2 Mt in 98/99 Oil: 23.5 Mt Meal: 102.3 Mt	Shells: 31 Mt in 98 Seed (shelled): 22 Mt
World production ranking	3rd cereal (after wheat and maize)	2nd cereal (after wheat)	1st oil crop (50% of world oil crop production)	4th oil crop in tonnage (after soybean, cottonseed and rapeseed), first place in terms of oil content
Production variation	Paddy: -1.5% 98 compared to 97 (flooding in Asia, drought elsewhere, sharp falls in production: China, Bangladesh, southern cone of AL, etc) Normal trend: +3%	+3.3% 99/98 compared to 97/98 as good production levels in USA and China (but disparities) Normal trend: +2%	+9-10% 98/97, significant increase in last 3 years (increase in areas in USA and Brazil, increased yields in Argentina)	+8.4% 99/98 compared to 97/98
Production forecast	Paddy: 582 Mt in 99	602 Mt in 99/00	154.9 Mt in 99	-
World trade:production ratio	Processed rice: 6%	11%	Seed: 24% Oil: 27% Meal: 35%	Total shelled seed, oil, meal: 15.5% (shelled seed basis) Oil alone: 6% (decreasing) Meal alone: 9% (decreasing) Main exporting/producing countries: Argentina (56%), Vietnam (32%), USA (30%), Senegal (28%), Sudan (19%)
World trade	Processed rice: 27.5 Mt in 98 (historic record)	60-70 Mt	Seed: 38.6 Mt in 98/99 Oil: 7.3 Mt Meal: 38.1 Mt	Peanuts: 1.2 million de t 98/99 Oil: 267 000 t Meal: 422 000 t

	Rice	Maize	Soybean	Groundnut
World trade variation	+45% 98 compared to 97 (increased imports in Asia, particularly Indonesia, Bangladesh, Philippines)	+1.6% 98/99 compared to 97/98	Seed: slight decrease in 98/99 compared to 97/98 (falling exports from USA, increased exports from Brazil, increased imports by China Oil: sustained growth, increased exports from Argentina, increased imports by India Meal: stable (increased exports from Argentina, decreased imports by China)	Depends on products, overall – 8.5% over last 4 years Peanuts: +5%/yearOil: down last 3 years (reduced imports by Indonesia and Thailand) Meal: sharp decrease (particularly Asia)
World trade forecast	Processed rice: 22 Mt in 99	65.4 Mt in 99/00	-	-
Main producing countries	China (193 Mt 98), India (127 Mt), Indonesia (49 Mt)	USA (40% 248 Mt 98/99), China (20%, 124 Mt), Brazil (32.5 Mt), Argentina (14 Mt), Indonesia (6.5 Mt), South Africa (6 Mt)	Seed: USA (47%, 75 Mt 98), Brazil (20%, 31 Mt), Argentina (12%, 18.7 Mt), China (9%, 13.7 Mt) Crushing: USA (42.5 Mt 98/99), Brazil (21 Mt), Argentina (16 Mt), Europe (15.5 Mt)	Seed: China (6.7 Mt 99, stable), India (5.8 Mt), Nigeria (1.8 Mt), USA (1.2 Mt, stable), Argentina (0.7 Mt), Africa (25%) Oil: China (1.9 Mt 99), India (1.6 Mt), Nigeria (0.3 Mt), Sudan (0.2 Mt) Meal: China (3 Mt 99), India (2.2 Mt), Nigeria (0.4 Mt), Sudan (0.2 Mt), Myanmar (0.2 Mt)
Main importing countries	Indonesia (6 Mt 98, exceptional), Iran, Saudi Arabia, Philippines, Brazil, Japan, Africa	Japan (16 Mt 98/99), South Korea (7 Mt), Taiwan (4.5 Mt), Malaysia (2.1 Mt) (slowing), Brazil, Mexico (4.8 Mt), Middle East (up)	Seed: Europe (15.8 Mt 98/99), Japan (4.6 Mt), Mexico (3.5 Mt), China (3.5 Mt) Oil: China (1.7 Mt 98/99), Iran (0.7 Mt), Europe (0.5 Mt), India (0.4 Mt), Pakistan (0.3 Mt) Meal: Europe (18.1 Mt 98/99), North Africa and Middle East (3.8 Mt), Latin America (3.6 Mt), China (2.5 Mt)	Peanuts: Europe (0.6 Mt), Indonesia (0.2 Mt) Oil: France (67 000 t in 98/99, down), Italy (48 000 t), Hong Kong (35 000 t) Meal: France (159 000 t), Thailand (75 000 t), Indonesia (32 000 t)

	Rice	Maize	Soybean	Groundnut
Main exporting countries	Thailand (6.4 Mt 98), Vietnam (3.8 Mt), USA (3.2 Mt), India (4.5 Mt), Pakistan (2 Mt), China (3.8 Mt)	USA (60%, 46.5 Mt 98/99, down), Argentina (20%, 9 Mt, up), China (3.5 Mt, Asian market), Hungary (1.2 Mt), South Africa (0.5 Mt)	Seed: USA (21 Mt 98/99), Brazil (9.5 Mt), Argentina (3.3 Mt), Paraguay (2.5 Mt) Oil: Argentina (2.7 Mt 98/99), Europe (1.5 Mt), Brazil (1.5 Mt), USA (1 Mt) Meal: Argentina (12.5 Mt 98/99), Brazil (10.8 Mt), USA (6.1 Mt), Europe (4.3 Mt)	Peanuts: China (0.3 Mt 98/99, 21%), Argentina (0.3 Mt, 20%), USA (0.2 Mt, 19%), India (0.2 Mt, 13%), Vietnam (4%) Oil: Argentina, Sudan and Senegal (down) Meal: India, Argentina, Sudan and Senegal (down)
Key facts	Strong trade growth in 98 linked to falling production (bad weather)	Strong production growth in Asia (increased yields), slowing elsewhere (lower yields)	Weakening of demand due to Asian crisis	Since mid-90s, increase in production due more to increased areas than increased productivity
Prices	Import West African port in current F/t, average, CIF 1998 USA grade 24% FF 2599; Thai 5% FF 1990; Thai 35% FF 1730; Viet 35% FF 1718; Thai A1 super FF 1476	Export /World Bank/FOB Gulf ports US$ 95.9 Jan-March 99	May 99 Rotterdam/t: Seed CIF US$ 189 Oil FOB US$ 428 Meal FOB US$ 140	40/50 sorted shelled seed (HPS) CIF Rotterdam Jan-July 99: US$ 860-880/t Mean oil price Oct 98-Sept 99: US$ 998/t Mean meal price Oct 98-Sept99: US$ 142/t
Prospects	Increased production, reduced trade but still higher than 97 level, continued low prices	Surplus capacity USA and Argentina, Chinese surpluses, price stabilization at low level since early 90s, strong trend towards falling prices; Requirements for animal feed = driving force behind demand (Asia, Latin Am.) but crisis in Asia	Chinese meal imports to pick up, continued low oil price due to resumed Indonesian palm oil imports, dependence/GMO issue	Peanuts: increased consumption in Europe and more stringent health regulations Oil and meal: sustained demand (falling oil production in Senegal, Sudan, China, Argentina; ban on bone meal as cattle feed)
Consumption	Asia +100 kg/person/year Subtropical developing countries 35-65 kg/person/year West –10 kg/person/year	LDC + Mexico and southern Africa: high direct human consumption Higher income countries: high consumption by animals IC: expanding industrial processing	Use of whole seeds for human consumption concentrated in Asia	-

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3- Survey of cropping and seed production conditions in 3 Provinces

Soybean is produced in significant quantities in almost all provinces of Indonesia (see chapter 2), with a diversity of cropping situations that cannot be covered during a single short mission. A rapid but comprehensive survey was carried out in three contrasted provinces, with a view of providing an overall image of the crop in its various aspects regarding particularly the seed issue.

3.1 West Sumatera

3.1.1: Overview

The Province has a limited soybean production capacity at present : less than 10 000t out of 1,3 million tonnes at national level. Provincial demand, nevertheless, is high, local consumption is common and increasing especially in urban areas, and the Province is dependent on foreign imports (USA via Malaysia) for consumption supply through a network of small traders and processors. Seed is often imported from neighbouring areas (Aceh, Medan) by private companies (P.T Pertanian, Sang Hyang Sri) whose local processing capacity is low and who rely on their branches in other Provinces. Commercial seed utilization is in fact limited to State and NGO "Projects", including intercropping under young plantations of perennials, which account for around 20% of the total acreage under responsibility of the General Directorate for Forestry with no operational relationship with Food Crops. Local scientific back-up for the soybean crop is non-existing at present ; breeder seed, when utilized, is imported from Java.

The advantages of this Province for soybean production are linked to an existing local demand, to high availability of arable land and to the existence of an immigrant population from Java with good knowledge of the crop and willingness to expand it if they receive proper encouragement and support. The future of the crop, therefore, is dependent on the transmigration policy and on the incentives which could be given to soybean producers if the decision was confirmed to develop the crop : one of the first measures to be taken would certainly be the organization of a proper seed supply, beginning with the three major transmigration areas (very dispersed and distant from the main urban consumption centers) of PACANAM, SAWAH LUNTO SIJUNGGUNG and PESISIR SELATAN.

Crop husbandry is typical of Indonesian smallholder conditions. Soybean is grown either in rotation with rice, with irrigation, or under rainfed conditions in rotation or intercropped with maize ; off-season production for seed can be carried out in September-November, with low yields and poor quality due to harvest and curing under rain. Product is generally sold to "traders" with limited negociation possibility for the farmer ; prices have undergone a severe diminution form 1998 to 1999, due to cheap imports, but seasonal variations, after the main harvest season during which prices are low, are not considerable (between 1.500 and 2.500 R/kg, 1999 current producer prices).

3.1.2: Cropping systems

Interesting experiences of "farmer groups", running their crop on a loose cooperative basis, are supervised by Extension Services (Muoro District). 20 or so farmers will purchase inputs and sell their production in common, and major cropping operations are carried out within a mutual help system. Production goes to consumption (local traders or processors), in competition with grain imported from USA or Thailand, the latter often imported from the former. Unsuccessful attempts have been made to plant this material, superior to local varieties, but sterilized...

Farmers will grow soybean typically from February to May (according to local rainfall pattern) on dryland area, in rotation or interplanted with maize. Lowland cropping also occurs, with heavy disease incidence (mosaïc in particular) and frequent vegetation / fructification imbalances due to heavy soils and poor drainage. WILLIS variety is dominant and prefered for its early maturity (90 days) although seed is smaller than ORBA, another improved variety with a 95-100 days cycle.
Average field size is 0,75 ha, land is cleared by hand and crop residues are burned, with occasional tractor plowing especially in farmer groups.

Planting date under rainfed conditions is a problem, as the soil dries rapidly and the farmer, who has not enough seed, cannot afford to re-plant his field in case of failure. He is therefore dependant on the occurrence of rain at the proper time. Planting sticks are used, with 3-5 seed per hole and spacings of 20-20 cm with "bad" seed and 30 x 30 cm when good germination is expected. All farmers will use "some" fertilizer, with no accurate indication of rate or of balance between N (Urea), P (triple superphosphate) and K (ClK), except mentions of "official" recommendations. No organic fertilizer is applied and fallow, outside newly-cleared land, is rapidly disappearing with the intensification of the cropping pattern, and farmers complain that yields are decreasing. No regular follow-up of acidity is made since at "calcium project" was carried out in the early eighties, with good results, and extension officers mention acidity levels from 5,5 to 6.

Weeding is done by hand, but herbicide can be applied before tractor plowing. LEGIN inoculum is mentioned but seldom used after first planting in newly-cleared land. No fungicide is applied, either as seed-dressing or in the field. Insecticide (DECIS, REGENT) is occasionally used. Harvest is done by hand or with hand tools (sickles). Plant is rapidly threshed, with small hand, motor or bicycle-powered machines, or shaken by hand or beaten with flails and winnowed. Grain is bagged scarcely one week after harvest, which results in high moisture and incidence of acidity and fungal damage. On-farm storage is very limited and the produce is rapidly disposed of, often to traders directly on field side.

Average labour use can be estimated as follows (mandays per hectare) :

- Land clearing 4
- Land preparation
  - Plow + tractor 1
  - Hand..... 10
- Planting..... 10
- Fertilizer 2
- Weeding (hand) 14
- Harvest, drying 18
- Threshing, winnowing 22

- **Total (hand)**..... 80

3.1.3: Commercial operators

A small processor will use 1t/day of grain, and be delivered every 3 days in order to avoid storage cost and deterioration. Buying price (Oct. 99) is 2.500 R/kg. He will prefer imported grain and complain on local soybean being small, immature, dirty, splitered, with thick seedcoats and low extraction rates. Many will mix imported and local grain, the first for physical factors, and the second for taste preferences, more often for reasons of price and availability. Tempeh is always made from large-seeded imported soybean. Seed retailers in town will not sell soybean seed for reasons of low demand, limited planting season, short viability and the presence of "companies" and the jabal network providing directly the costumers.

Seed producing companies (PT Pertanian and Sang Hyiang Sri) are not heavily involved in soybean. They are constrained by the low viability of soybean seed, lack of storage facilities and the low financial return. They will preferably import seed from neighbouring company branches in Medan and Aceh, rather than pass contracts with growers. Their market is irregular and generally limited to

government actions and projects ; they will process willis variety, if not anything else. Their equipment consists of grading and cleaning machinery, often heritages from former projects, standard storage facilities (no temperature and moisture control) and rice dryers occasionally used for soybean. Their major commercial problem, besides price, is uneven demand and availability of good quality "candidate seed" to be processed for sale in a very small delay. Programming and adequation between offer and demand is problematic. Eventually, they would accept involvement in upstream seed multiplication, if it could help secure their supply. They sell only "pink label" seed, i.e. basic production with uncertain genealogy, no field control and only one month certification before planting. Price is 5 000 R/kg, seldom affordable for small farmers. Comparison with rice will give an indication of the low return/cost ratio of soybean seed, and an explanation for the low quantities sold (probably less than 200t /year in the Province) :

	Rice	**S.bean**
Seed kg/ha	25/30	40/60
Seed price R/kg	3.500	5.000
Crop yield/ha	4/5 t	0,8/1,0t
Crop price R/kg	1.500/1.700	2.000/2.500

3.1.4 : Research and extension

Research results going back to 1991, obtained on the acid soils prevailing in the area, indicate actual yields of 1300 kg/ha with a standard package including 500 kg of lime (dolomite), versus 800 kg without liming. **Acidity thus appears as the major agronomic bottleneck, with special incidence on soybean as rhizobial N fixation will decline as acidity increases.**

Extension services complain on varieties being unfit (low-yielding and not answering processor demand), and first generation seed received from research of poor quality. Relations with research are said to be poor, recommendations not appropriate to needs, and feed-back from the field not given proper consideration by research scientists. Programming of needs for seed multiplication is not considered satisfactory. Linking between extension services, Directorate of Seed Development, seed farms, administrative authorities, research centers (in Java) does not end up with proper adequation between offer and demand, from "Breeder seed" provided by Research to extension seed sold to farmers. The

official seed-flow is not operating as scheduled by the genealogical scheme, and each operator will buy and sell what he will or can. The ultimate user of the seed - the smallholder- will rely on his traditional mutual help network more than on the private or public operators of the official seed channel.

Credit problems are often mentioned. The banking system and its agricultural offshoots are said to be too elaborate and changing for the small farmer ; all too often, money is not at hand when inputs are available and vice-versa. Common accounts are not popular. Distribution of seed in kind, with repayment and interest at harvest, and specific revolving funds for other inputs, would be well considered. Much is expected from the recent INPRES PERBENIHAN extending to soybean seed growers groups the revolving credit system as already operating for paddy.

3.2 : East Java

3.2.1 : Overview

Soybean production is high in this Province accounting for one third of national production (460.700 t out of 1 305.000 t in 1998) ; yields are not superior to national average, due to over-cropping in a very densely populated area. Production increase should therefore be expected from intensification, especially in upland areas where the introduction of hybrid maize, with heavy fertilization and high return, could be a favourable factor for soybean grown in rotation or inter-cropped. High yields and costly inputs could not be sustained, on maize, without another crop and preferably a legume grown alternately. This offers promising prospects for soybean and groundnut who could beneficiate from carry-over effects of fertilizer applied to maize. Although many previous soybean operations have been carried out in East-Java, with results not meeting their targets, and production has been declining, this Province still offers a good location for a soybean intensification project.

Table 1 : soybean production
(.000t)

	National	East Java
1992	1.870	564
1993	1.709	549
1994	1.565	493
1995	1.680	487
1996	1.507	509
1997	1.357	511
1998	1.305	460
Mean	1.572	511
Yearly decline	5,6 %	3,2 %

Table 2 : Major food crops in E.Java

		Area (ha)	Yield (0,1 t/ha)	Production (t)
PADDY	1998	1.719.932	51,68	8.888.433
	1997	1.606.278	55,07	8.846.406
	1996	1.622.051	53,22	8.846.406
MAIZE	1998	1.329.863	29,45	3.915.865
	1997	1.102.519	28,36	3.126.669
	1996	1.269.529	26,92	3.439.154
SOYBEAN	1998	372.091	12,38	460.733
	1997	414.565	12,38	513.052
	1996	416.796	12,21	519.724

Source 1 and 2 : Provincial Extension Service

Small-scale processing of soybean (Tahu and tempeh cottage industry) absorbs the totality of local production, but processors complain about the quality :

- Grain dirty and uneven in size,
- Shrivelled grain resulting from immature harvest,
- High moisture content resulting from improper curing,
- Cracked grain,
- Small seed size making it improper for tempeh,
- Thick seed coat and low extraction rate.

The major problem, if not always mentioned, seems to be the convenient availability of imported seed, large in size, clean, graded and properly processed, regularly supplied, as proposed by local importers compared to the poor quality and uneven availability of domestic soybean. Price advantage in favour of domestic soybean is less and less attractive, although taste is sometimes mentioned as an advantage. This situation is general in Indonesia, and accounts for increasing soybean imports.

Problems posed by soybean crop development in Indonesia, illustrated by East-Java situation, call for no simple solution. The economic issue is determinant : under conditions prevailing in 1999, the average crop return/cost ratio at producer level, if he applies official recommendations, can be approached as follows (see page 18) :

- Production costs : 2.103.250 R/ha
- Yield : 1.500 kg/ha
- Producer price : 2.000 R/kg
- Gross output : 3.000.000 R/ha
- R/C : 1,4

The economic feasability of crop intensification is low and the farmer's priority concern goes to risk reduction.

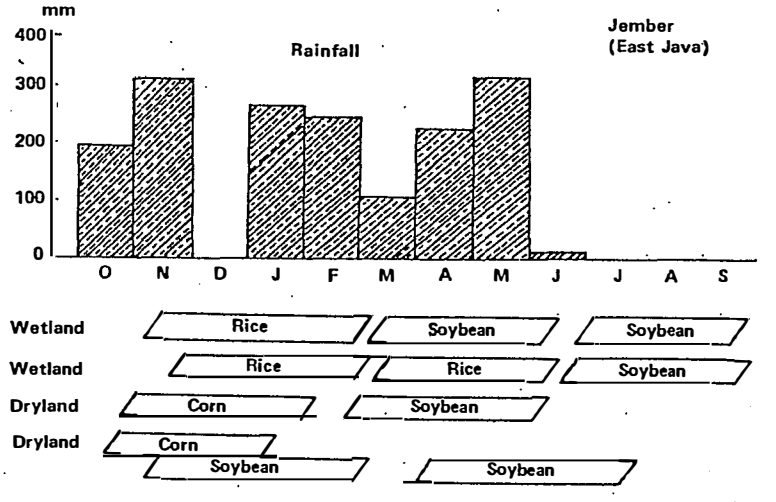
It appears that low monetary return, resulting from competition with cheap imports, remains the major economic constraint. This could be partly overcome through reduction of production costs and amelioration of crop husbandry including post-harvest technology, with priority given to use of low-cost improved seed and quality improvement of soybean products proposed on the domestic market.

3.2.2 : Cropping systems

Most of the arable land in Java is wetland. Average land holding is 0,9 ha per family. In most districts, soybean crop area is larger than the area cultivated, which indicates that the farmers cultivate soybean more than once a year on some of their land. Figure 1 gives indication of characteristic cropping patterns in a dominantly soybean growing district of East Java.

Figure 1

Rainfall distribution and cropping patterns in Jember (E.Java)



Source : CGPRT

40 % of the soybean acreage is grown in wetland and 60 % in rainfed areas. It is assumed that half of the planted area is monocropped, with no difference between wetland and dryland. 80 % of farmers will apply fertilizer, generally TSP at planting time and urea at peak of vegetative growth (10 to 30 days after planting). Pesticide is used when felt necessary, provided by retailers (shops, markets) or through farmers groups or coops. Yield and response to inputs (including seed) are higher in lowlands. Response to pesticide is higher in intercropping than monocropping, due to the continuous presence of soybean in the first situation. Fertilizer application was high in the eighties (165 kg/ha on average), certainly much less nowadays. In spite of this near-optimal application, the response to fertilizer was then very small : 1-2 kg of additional yield for 1 kg of fertilizer, which should certainly not be profitable nowadays. Seeding rates are variable, and often higher than recommended. The high seeding rate is the result of the wish of the farmer to counterbalance the poor quality of his seed and adverse germination condition due to a number of factors, among which lack or excess of soil moisture, soil compacity, fungal and insect pests.

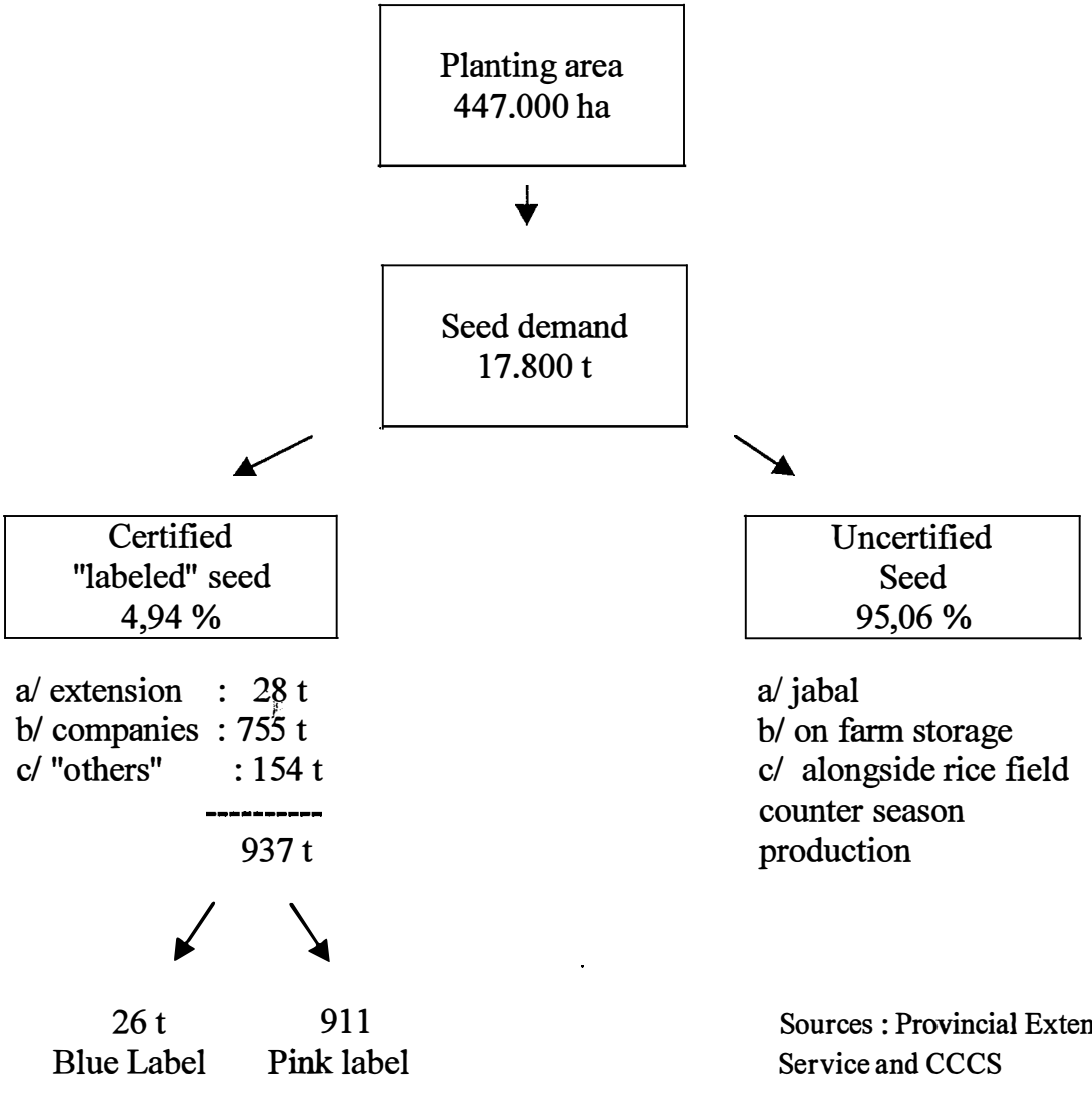
The farmers visited in 1999 used on-farm seed in a proportion higher than in other areas, probably because they have soybean at hand all year round or get it from the neighbourhood . Storage period seldom exceeds 3 months, and on-farm storage, in a cool room, is done in bags piled on a low platform and carefully checked for insect pests and rodent damage . Most of the seed capital, however is still provided through the jabal system .

Table 3
Soybean seed use in East Java

Fiscal year	Planting area (.000 ha)	Seed demand (40 kg/ha .000 t)	Certified seed avaibility (t)
1995-1996	471	18,9	905
1996-1997	432	17,3	1088
1997-1998	458	14,3	447
1998-1999	447	17,8	937
Average	427	17,1	844

Source : Provincial Extension Service
E. JAVA

Figure 2 :
Soybean seed use in East Java – 1998/1999



Sources : Provincial Extension Service and CCCS

Planting is done by hand, with planting sticks, at 15 x 35 spacings or closer when seed quality is low. The "suryan" cropping system, consisting of elevated ridges alternating with low stretches of ricefields, is popular in certain areas and could be given more attention ; cassava is planted on the edge of the ridges then maize, and soybean or groundnut in the centre. Irrigation of the ricefields provides moisture to the ridges and cropping is possible all year round . Other components of the cropping method follow roughly the same pattern as in West-Sumatera : cultivation, weeding, harvest by hand ; hasty harvest in order to avoid shattering ; hand or mechanical threshing followed by winnowing .

Farmers consider that best cropping period is dry season when complementary irrigation is available : yields may then reach 1,8 t / ha, versus 0,8 /1,0 t in wet season when pests and diseases take a heavy toll. Local varieties, surprisingly, are still in common use, perhaps because on-farm seed production is more common than in other areas, and because these varieties are earlier-maturing (although therefore less productive than willis and other improved varieties). The major bottleneck and most important yield component in all situations where 3 crops/years are carried out, is planting date : those who plant late may not be able to postpone sufficiently the irrigation dates, which should provide water at the optimal time, and are exposed to the risks of harvesting and drying in rainy conditions. This factor is determined by the organization of paddy harvesting in the previous season and the labour requirements for lands preparation and planting operations.

3.2.3 : Commercial operators

Seed processing companies consider market prospects for soybean seed are good and potential demand is high. They get seed from State Seed Farms, farmer groups or different projects operating with Extension Services, and sell at 3.500/4.500 R/kg, versus 3.000 R/kg for the dominant "pink label" category. Average break-down can be evaluated as follows, for seed provided by farmer groups :

• Purchase candidate seed	2.100 R/kg
• Processing rate 80 % : cost price becomes	2.625
• Processing cost (cleaning, drying, grading)	200
• Bags	100
• Certification tests	10
• Packing	15
• Transportation	50
• Total cost	3.000 R/kg

Processors consider that reasons why farmers do not purchase from their firms are :

- Too high prices
- Unsufficient avaibility and selling points
- Lack of awareness for differences in quality and return in yield .

The seed flow, there again is irregular : in one situation, no seed was received from the institutional system this year and the processor had to buy "jabal" seed, with guarantee from certification services, and resell it to his customers after processing. The firms, in fact, rely more on theirs relations with so-called "seed growers" than on the States Farms network . Varietal purity is not considered in the processing, which consists in drying/grading/cleaning/bagging. Age and viability of purchased candidate seed is a matter of confidence with the supplier and of empirical testing ("chew and taste !") ; the firms have good relationships with their suppliers and customers, have their own agents in the field, work in good intelligence with certification and control services . Soybean is a small market for them, and more or less an advertising item for their rice seed customers.

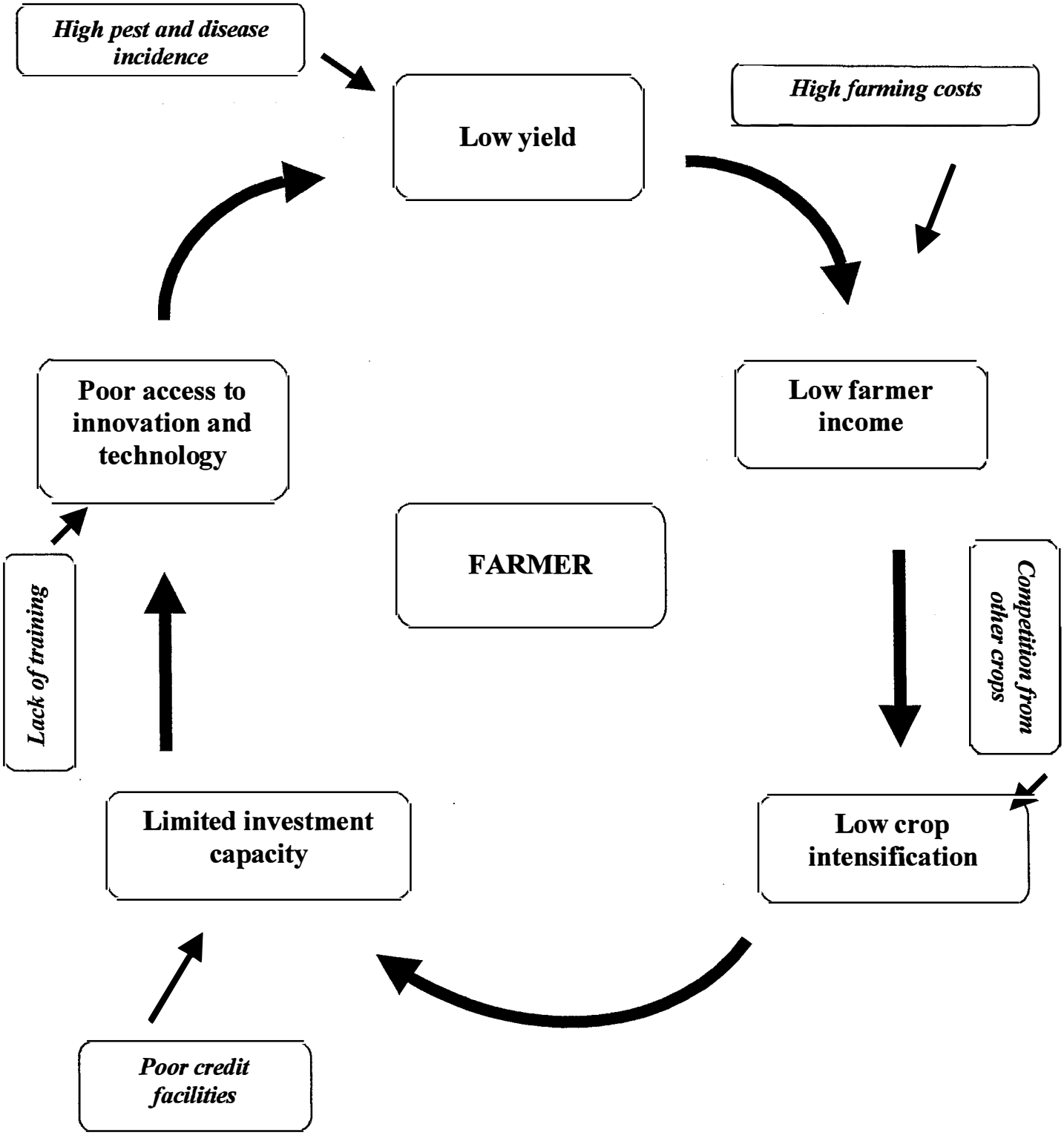
3.2.4 : Extension Services and public seed operators

Proximity with research stations and high level of technicity do not result, in East Java, in a situation basically different from what takes place elsewhere : on the contrary, farmers will rely on their own capacity to produce seed and the jabal system accounts for over 95 % of the soybean seed capital .

State farm managers have difficulties in programming their production and will rather produce less than meet the risk of having to sell excess production at low price on the consumer market . Commercial firms will preferably deal with their own network of farmers groups and multiplicators rather than with state farms. Farm managers run their budget as well they can, following the rules of public services, and keep no account of the actual seed production costs. Official figures, when available will be provided by Extension Services . Farm yields are low, presumably because of high acidity in fields that have not been chosen for soybean production and which badly need rehabilitation. Agricultural equipment including post-harvest, as well as storage facilities, are not well adapted or utilized for production and processing of quality seed. Basically, there is little incentive for improvement in a system where seed farms without any comparative advantage are in unfair competition with producers and commercial operators who can get or provide the same seed (if not better) at a better price from other sources : Nestle, in East Java, stores and redistributes its own seed to its contract farmers .

Extension Services Officers, in Java, have a very accurate and realistic comprehension of the soybean problem and of the future of soybean as an income crop. They consider that acceptability by the processor, in terms of seed size and technological characteristics, should be given more consideration . Commodity research should include adaptive research and ground-level technologies, particulary in the seed sector, and farmers should be taught to produce seed in the best season and store it, rather than produce in drought conditions and then harvest and process under rain. Their analysis of the sector, given in figure 3, can be extended to the national level .

Figure 3 :
Constraints to soybean crop intensification in East-Java



Source : Provincial Extension Service

3.2.5 : Information from Research

Soybean scientists in Malang gave us their point of view on the situation of the crop in Indonesia .

Around 30 current varieties of soybean are made available to development, but there is no official recommendation in the form of a varietal map. Multiplication of any variety is the responsibility of local authorities or the choice of individual growers . Personal involvement of breeders in the seed issue is low, for lack of financial and professional incentives ; production of breeder seed is therefore limited and there is no clear rationale, in the form of an efficient research-development linkage, sustaining the soybean seed system in Indonesia. A catalog decribes the existing germplasm. Early maturing varieties (80 days) are given preference for rotation with rice/rice, medium varieties are used in dryland conditions in rotation with one rice. Size of seed is now given attention : Bromo is superior to Willis from that point of view, but it is susceptible to virus and cropping conditions are not yet quite clear. Other varieties are suitable for multiple cropping (shade tolerant), such as Pangorongo, or tolerant to rust, beanfly, acidity, etc, the latter not yet released . **There is no prospect for any varietal break-through in the predictable future, that might determine a radical improvement of the cost/return ratio of the crop .**

Producer price of soybean is getting lower and lower for reasons of competition with cheap imports, but preference of processors is often determined by reasons of convenience and easy supply. **The seed flow is not regular from research to end-user, for reasons of budget and poor vertical organisation due to the multiplicity of decidors and operators : supply and demand do not meet and market information is lacking.** The seed sector is dominated by privates who have little consideration for seed regulations. Jabal system should be improved through post-harvest technology, with two major options : improve storage and improve off-season production when harvest coincides with rains. Regulatory aspects should be revised as well : the major difference between " blue label" and "pink label" seed being the genealogical pedigree of the former, why should blue label be granted 3 months authorisation for sale and pink label one month only ? The problem of seed-born disease is not given sufficient attention . Detection may require elaborate equipment, but discarding is sometimes easy and could be done at early stages of vegetation : this is the case for mosaïc, a major viral disease.
We received confirmation, in Malang, that **no research result could demonstrate a significant advantage, in terms of yield or fertilizer response, of "blue label" seed as compared to jabal seed of the same variety .**

The justification of the genealogical seed flow from breeder seed to blue (or pink) label seed distributed to the farmers proceeds from the hypothesis that varietal purity remains high and the variety itself is high yielding. This may not be the case in Indonesia : Japanese breeders, working on Willis variety from

local origin covering 60 to 70 % of soybean acreage in the country, have demonstrated the important heterogeneity of this planting material. Variability of plant size and shape, internodal length, seed characters (size, shape, hilum colour) is very high. Standard characters have been defined, undesirable lines after yield evaluation have been discarded, and more than 50 selected lines are presently under study and will be screened . The potential outcome of this work, when pure line selection will be carried out, could be a 3 % increase in global yield, better seed characteristics and greater regularity of plant growth. New breeder seed could be supplied in East Java, if accepted by research authorities. Same work will be undertaken on another variety, Bromo (manchurian origin), less shattering than Willis, large-seeded suitable for tempeh but with a lower viability.

3.3 : South Sulawesi

3.3.1 : Overview

Under the "Upaya khusus" (upsus) programme which has been established to increase soybean production through intensification and extensification, South Sulawesi has been identified as an area suitable for rapid soybean development.

Planting area in South-Sulawesi has varied, in the past five years (1994-1999), from 40.000 to 80.000 ha with yields similar to the national average (1,2t/ha). 49.500 t were recorded in 1998, out of 66.700 t for the whole archipelago. Land pressure in the Province is low and the potential area for soybean extension, in the five major producing Districts (Luwu, Soppeng, Wajo, Bone, Mamuju) is estimated by Extension Services around 50.000 ha ; another 20.000 ha could be made available in other Districts where the production conditions are favorable (Bulukumba, Gowa, Pangkep, Maros, Sidrap, Polmas). South Sulawesi is thus in a situation intermediate between West-Sumatera and East-Java, with a good level of crop management by the farmers and possibilities of extension if proper incentives are given (table 4) .

Cropping rates, cropping patterns and crop husbandry are not significantly different from those observed in the other Provinces visited, but the South-Sulawesi peninsula is characterised by two symetric areas on both sides of a longitudinal mountainous backbone, resulting in opposite seasonal rainfall patterns. Soybean is grown in April-September on one side and October-March on the other, with many intermediate situations. This greatly facilitates transfer of seed from one area to another through an elaborate jabal-sim system. The institutional seed-multiplication organization accounts for a very small percentage of the total seed capital, making difficult the introduction and distribution of new varieties. South-Sulawesi is the only area visited where the nation-wide willis variety is not dominant .

Table 4 :

Soybean cropping areas in South Sulawesi

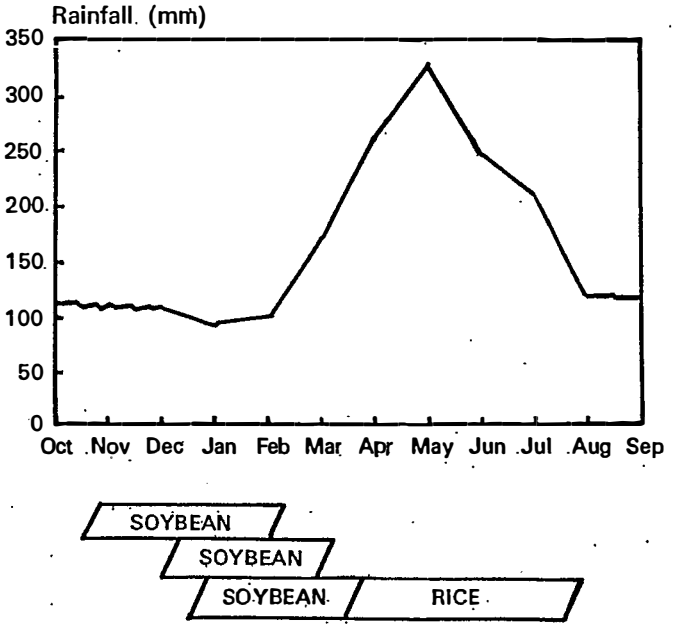
Districts	**Land availability** (.000ha)	**Soybean crop** (.000 ha)	**Soybean development potential** (.000 ha)
Luwu	21	8,2	12,8
Soppeng	12,5	9,1	3,4
Wajo	40	20,5	19,5
Bone	40	38,4	1,6
Mamuyu	12,5	7,5	5,0
Sub-total	126	83,7	42,3
Bulukumba	7,0	3,0	4,0
Gowa	7,0	4,2	2,8
Ponghep	6,0	4,4	1,6
Maros	4,0	1,6	2,4
Sidrap	7,5	4,1	3,4
Pomas	7,5	2,1	5,4
Sub-total	39,0	19,4	19,6
TOTAL	165,0	103,1	61,9

Source : 1995 statistics
through Provincial Extension Service

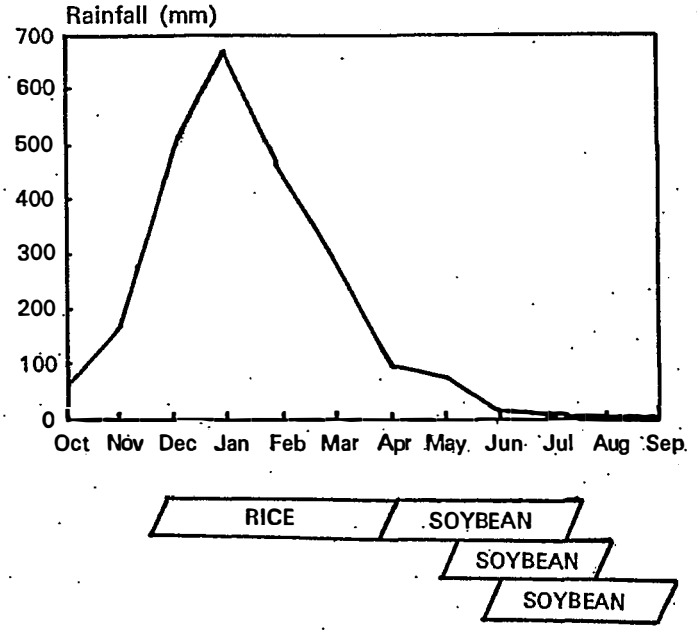
Figure 4 - Figure 5 :

Rainfall patterns and growing periods for soybean in South Sulawesi

East Coast



West Coast



Source : CFPRT

3.3.2 : Management of seed supply

Lack of sufficient high quality seed delivered at the correct time is, again, a major constraint. In the past, seed was supplied to South Sulawesi farmers from East Java and South-East Sulawesi ; these Provinces were still supplying 50 % of the requirements in 1991. Field to field supply was later encouraged, along with season to season supply in the same area ; the strategy of the seed multiplication and distribution, including the institutional operators, is still based on the implementation and management of this traditional concept. In this connection, soybean planting time is sub-grouped into three geographical areas (see figure 6 and annex) :

- April to June :

  This planting time predominates in the West-coast area during the dry season and some East-coast districts during the wet season.

- July to September :

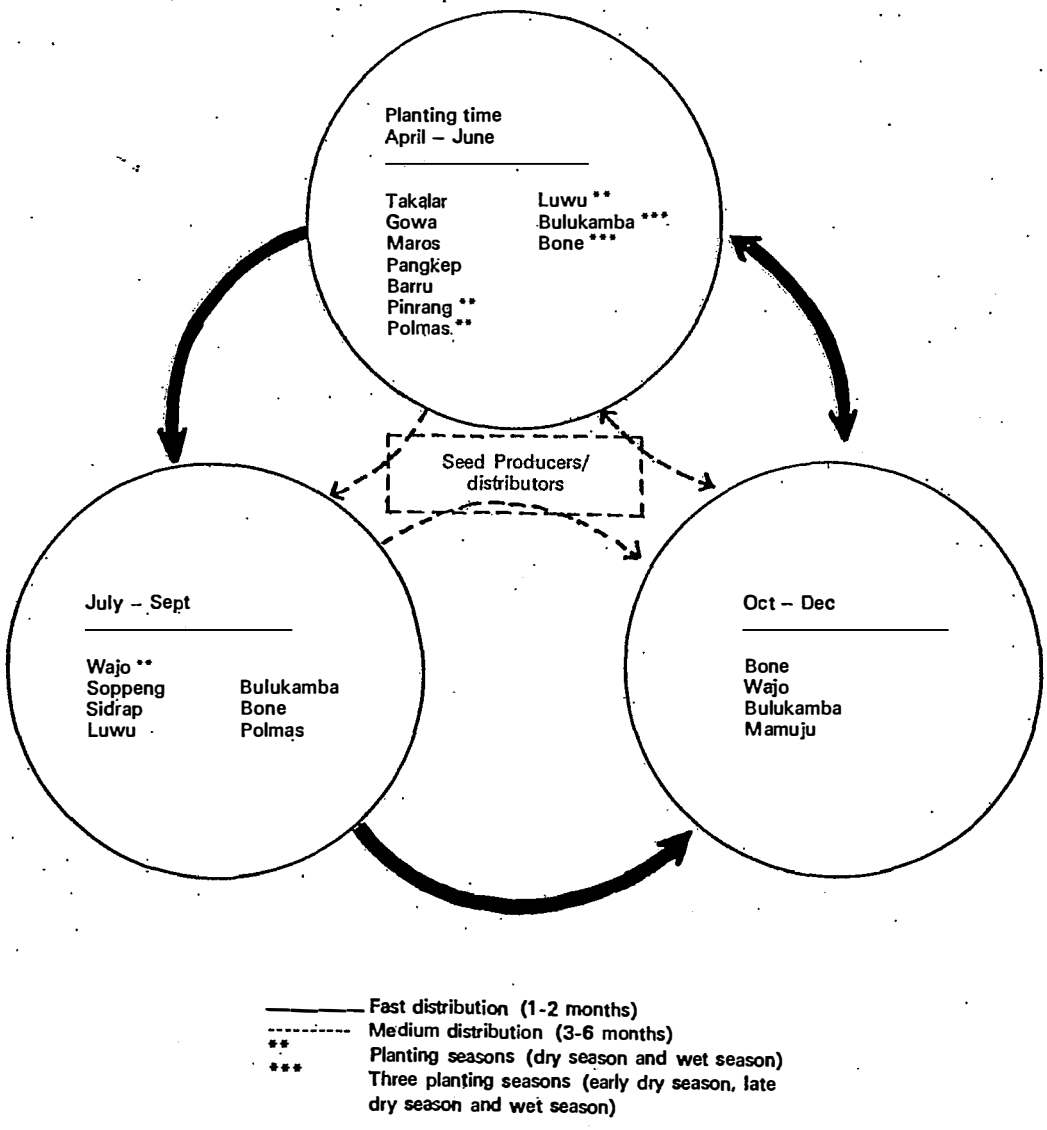
  This planting time predominates in the Central region and in Luwu districts in the North-East area.

- October to December :

  This planting time predominates in the East-Coast area and in Mamuyu district (upland).

Figure 6 :

Seasonal and field to field seed flow in South Sulawesi



Source : CGPRT

3.3.3 : Seed supply operators and problems

Extension and certification services

Breeder seed is provided by Java, upon request, and multiplied through the usual scheme and network of State farms and their associates.
Over the 1994-1995 to 1998-1999 period, average yearly distribution was 835 t of "blue label" seed added to 1.710 t of "pink label" certified by CCCS and sold by the commercial operators. In 1998-1999, production of the different levels of multiplication is given in table 5, with an unusual high rate of blue level.

Table 5 :

Soybean certified seed production and utilization by classes in South Sulawesi
(t, 1998-1999)

	Foundation S.		Stock S.		Extension S.		"Pink label"
	Prod	Util	Prod	Util	Prod	Util	
Seed farms	1,74	1,53	34,4	0,80	20,0	20,0	-
Companies							
PTP	-	-	-	5,0	187	187	-
SHS	-	-	-	13,3	479	479	550
Seed growers	-	-	-	23,8	595	595	-
TOTAL	1,74	1,53	34,4	42,9	1.281	1.281	550

Source :
Provincial Extension Service

Agricultural research is carried out in the Province by the Institute for Technical Agriculture (BPTP), belonging to Research and Development Agency, in charge of adaptive research and developing links between upstream research and downstream development. Representation is at provincial level only (nothing in the districts) and technology is transferred through the local governorates.

BPTP has contributed trials for soybean seed production, control and storage ; publications are vaguely mentioned but no figure or documentation was provided. Seed-growers associations with collective use of basic equipment and encouragement to on farm seed + production and storage are advocated but no actual action is mentioned.

The official "technology package" is an adaptation of the general recommendations issued all over the country, with little regard to location-specific or individual conditions.

Figure 7 :

Soybean technology package for South Sulawesi

	West side			East side	
	Rainfed	Irrigated		Rainfed	Irrigated
Farming Activity	Rainy season	Dry season I	Dry season II	Rainy season	Dry season
Planting Time	Apr/May (after rice)	Nov/Dec (not enough water for rice)	Aug/Sep (after rice I)	Nov/Dec	After rice
Variety	Willis + early locals	Willis + EL	EL	Willis	Willis
Land preparation	Minimum tillage and irrigation works as requested				
Planting	Spacings as recommended, 2-3 seed/hole				
Harvest	When leaves drop and pods became dry and yellow				
Drying	In the field, stems upside down, until moisture 12 %				

Commercial companies follow the same scheme of action as in the other Provinces. The one visited owes a small processing unit and operates with its own network of farmer groups of seed growers who will, more than often, do the processing themselves. The company representative will check on samples and if the tests are positive, the farmer receives bags and tags ! Demand varies between 500 – 900 t/year, including requests from other islands (Irian, Kalimantan).
90 % is supplied by farmers, 10 % is factory-processed pink label. Seed "processed" by farmers is bought 2.500 R/kg (July 1999) and resold 3.600 R/kg... processing cost break-down is said to be as follows :

Candidate seed purchase	3.250 R/kg
Processing	100
Bags	100
Packaging	5
Tests	3
Certification (?)	2
Transport	120
(processing rate 90%)	
Sale price	4.000

District Extension Services will organize farmers groups, and supervise collective action for credit, inputs supply and marketing. A "revolving fund" is operating for group purchase of seed, inputs and equipment ; accounts are individual and interest is repaid to the bank each year after harvest.

A remarkable farmer group collective soybean field was visited in Leworeg (Soeppeng district) : 25 ha in ORBA variety, monocropped, fertilized, with revolving fund (TABUNGAN KELOMPOK) providing for inputs. Major bottelneck is said to be planting time. Planting is done together. This group uses hollow planting sticks, holding several liters of water, which allow for planting even on dry soils : this is a local, recent innovation which owes nothing to institutional research.

Weeding is individual, as well as fertilization (a personal choice) ; harvest is done on a mutual help basis but each farmer is owner of his own crop. Drying is individual, threshing is collective. The group "chief" negociates the marketing, and the crop will be sold as "candidate seed" to a seed company.

4- Agro-economic background of soybean seed production in Indonesia

4.1 : Soybean utilization : situation and trends

Considering the five major food crops ; rice, maize, soybean, cassava and groundnut, soybean represents 8 % of cultivated area and 11 % of total crop value. Rice accounts for 62 % of both crop area and value, maize for respectively 18 % and 13 %, cassava and groundnut being equal or inferior to soybean (F.Lançon,1995) . National production is concentrated in Java and North Sumatra, with other important areas in Bali and Sulawesi (annex and chapter 2).

Soybean utilization in Indonesia is characterised by its dual purpose, in a dominant alimentation system based on rice (figure 8).

- Products for direct human consumption, provided by the traditional soybean cottage industry (tahu and tempeh) ;

- Products of a growing agro-industry based on poultry, consuming soybean oilcake, incorporating more animal proteins in the food habits especially in urban areas .

The latter system differs from the first by the high degree of concentration of industrial activities dominated by less than a dozen major operators. National production is entirely absorbed by human consumption and the cottage-industry distribution network, highly dispersed. Local varieties having low extraction rates and other unfavorable characteristics aggravated by poor post-harvest technologies, and national production being insufficient, the agro-industrial system relies entirely on imports .

Soybean products play an important and increasing role in Indonesia alimentation systems, particularly in Java. With per capita use around 10 kg/year, needs of the Indonesian population are comparable and often superior to those of north-eastern Asia (Taiwan 13,3, Japan 9,3, China 6,3) and much superior to those of neighbouring countries where 3 kg is generally a maximum. Tahu and tempeh represent respectively 42 and 55 % of total soybean transformed for human consumption ; fabrication by a very high number of small units, followed by immediate distribution, is well adapted to products with shelf –lives not longer than 2 to 3 days . Demand has grown from 5 to 10 kg per capita/year in

the 1980-1990 period, increase being highest among populations of non-Javanese origin (the share of Java in total national production has decreased from 70 % to 40 % within the same period).

According to a national census carried out in 1993, consumption is higher in urban areas and equally balanced between tahu (unfermented coagulated "cheese") and tempeh (made from fermented whole seeds or splits), as shown in table 6 .

Figure 8 : The soybean commodity system in Indonesia

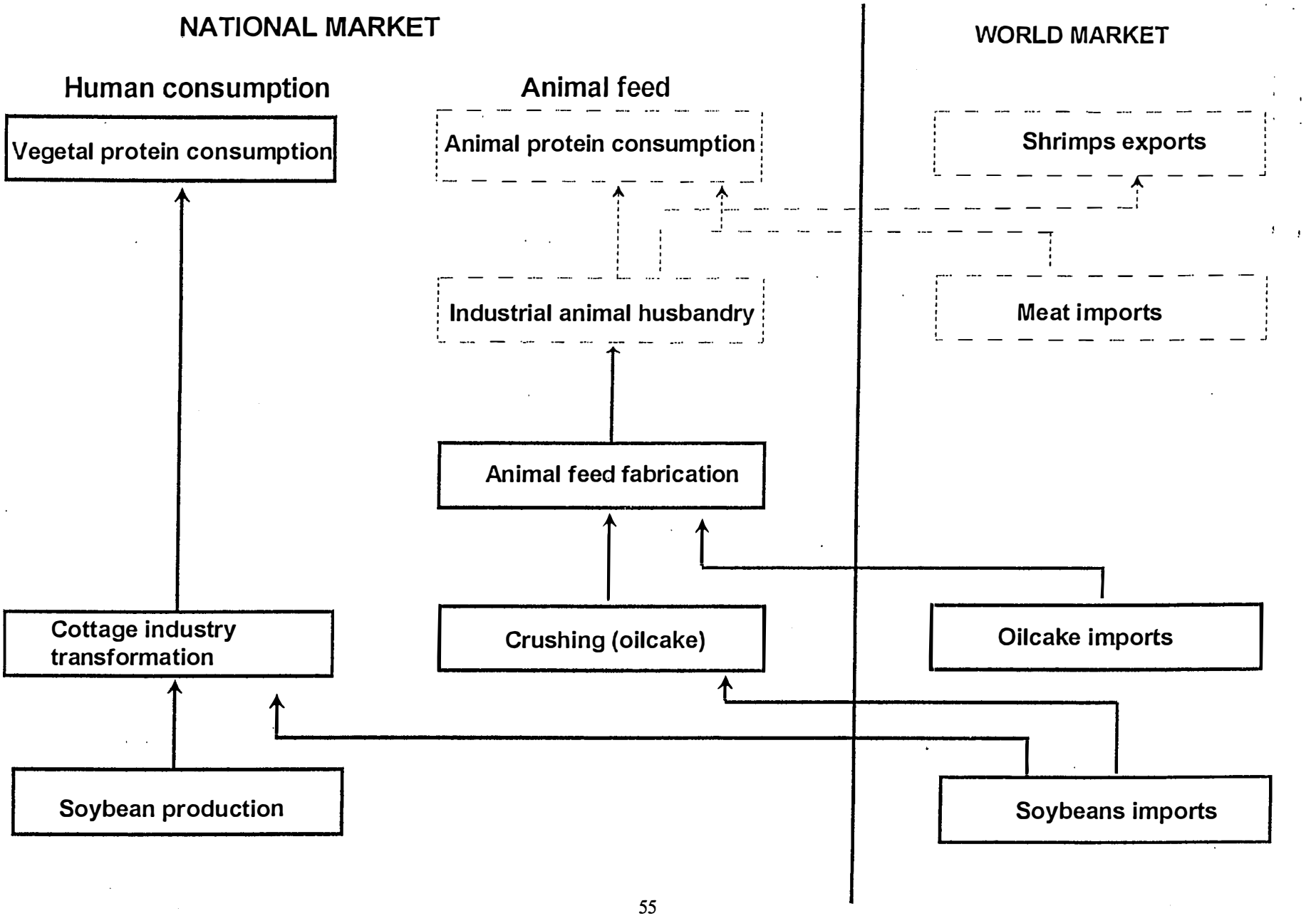


Table 6 :
Soybean consumption (kg per capita)

	Village	City	Village + City
Grain	0,13	0,07	0,15
Tahu	4,06	7,12	5,04
Tempeh	4,52	6,50	5,20
Lainnya	0,04	0,09	0,05

Source : 1993 census

At the same period, use of soybean for animal feed, processed by large scale industry, was overwhelmingly dominant over cottage-industry, while new products (sauce, kecap) concentrates and drinks appeared on the urban markets (table 7) .

Table 7 :
Soybean processing (tonnes)

	1982	1986	1990	1993
Kecap	-	2 823	3 459	2 659
Tahu, tempeh, tanco	8 756	13 857	22 592	27 389
Animal feed	69 960	131 430	110 945	136 249
Concentrate	-	-	1 414	8 137
Drink	-	28	97	804

Source : Central Bureau of Statistics

The national soybean market, before the crisis, was undergoing deep transformations linked to the development of the poultry industry (chicken and eggs), cattle industry remaining traditional. The resulting demand on animal feed, even before the crisis, might have been overestimated, as the industry capacity for animal feed production is (and already was) severely under-utilized ; large-scale production of poultry and eggs is presently facing difficulties in the new economic context, and the demand for soybean oilcake has already slowed down significantly. The animal feed system has been more severely hit by the depreciation of the Rupiah, because it depended mainly on imports. Oilcake imports have increased from 128.000 tonnes (1989-91 average) to 500.000 t in 1993 and almost 1.000.000 t in 1996 . In 1997, imports went down by 50 % .
Effects of the financial crisis on the human consumption system have been less dramatic, the first reason being that local soybean production still provides more than 60 % of the soybean transformed into tahu and tempeh. The second reason is that BULOG, who had a monopoly on soybean kernel imports until August 1997, has regulated the offer to KOPTI members (transformation cooperatives), but stocks are now getting low and price increases are to be expected.
In the long term domestic demand could be influenced by changes in alimentation styles, reducing costly products such as poultry, giving advantage to tahu and tempeh .

In conclusion, liberalization of the soybean market could have limited negative side-effects in the short and medium terms, because national production, after devaluation of the Rupiah, will be more competitive compared with imported soybean. The terms of this balance will have to be carefully examined. It is not certain that price increase of soybean products would result in reduction of domestic demand, if Indonesian consumers substitute vegetal proteins to animal proteins ; it is to be kept in mind that tahu is often sold in the same retailer shops as chicken ...

There is, therefore, no reason to be pessimistic as the possibility and appropriateness of increasing soybean production in Indonesia, and as to the possibility of reducing soybean imports .

4.2 : Socio-economic aspects of soybean production and development policy

This problem has been given an in-depth evaluation in chapter 2. The following information will only give a brief account of the debate and policy-making decisions in Indonesia.

4.2.1 : Liberalization : the hard line

Some consultants and organizations consider that any restriction on imports would cause (and therefore have caused) a drag on the economy, and that Indonesia has an opportunity to capture economic gains from more open participation in soybean trade, as is the case within the "liberal" system. The argument in favor of crop diversification is considered specious when exposure to risk is increased, which may be the case with palawija crops technology and market mechanisms : rice is grown in a much more controlled environment for water and inputs that can be achieved with any of the palawija crops and in particular with soybean. There is no reason to diversify farmers out of rice into a crop with a weather market potential, and to invest in crops which provide lower returns.

Since 1975, BULOG's soybean import monopoly and restrictive import practices, resulting in high domestic prices, have increased incentives for Indonesian farmers to grow soybean. Following the success with rice, a special intensification program (INSUS) was introduced for soybean in 1980. The packages for soybean were designed in the same fashion as those for rice and maize. Inputs were provided at costs well below the border price, in spite of (and with no consistent result on) a number of negatives features :

- continued concentration of production on Java ;
- low yields on outer islands, due to low farmer technology, poor water control and marginal soil fertility ;
- low returns compared to rice and competing crops, due to the risk factor ;
- already high levels of input use, combined with the fact that no high yielding variety can be expected to open large production increases in the near future.

Objectives of the food policy, in the liberal perspective, should be more carefully evaluated in terms of current policy regarding soybean production and market factors :

- The stable world market suggests that the danger of inadequate supply is minimal ;
- The "secondary role" of soybeans in consumption patterns implies that adjustments and supply shortages will not be too difficult ;
- High producer prices distort consumer behaviour and subsidized growth of soybean production require considerable economic ressources ; soybean

producers would thus receive injustified transfers from consumers and the government : the high price functions as a consumption tax, through a very expensive transfer channel to poor producers. For every Rupiah actually transferred, more than 5 where lost (before 1990) through policy-induce inefficiencies.

Indonesian policy-makers are given two lines of alternatives, presenting advantages and disadvantages (according to advocates of the "liberal" line) :

1- Eliminate imports through increased production : this would

Increase efficiency losses : cost per ton will continue to rise as policy pushes production up.

Reduce budget revenues from sales of import at domestic prices, and increase the cost of incentives for production (including imports of other commodities).

2- Eliminate Government protection of soybean production, through increased imports gradually driving domestic prices down : this would

Generate important efficiency gains, declining over time as the domestic price drops toward the border price.

Increase the level of soybean imports, thus perhaps decreasing imports of substitutes.

Increase the level of soybean consumption through less expensive soyfoods, thus adressing the true nutrition dimension of soybean policy.

(Ref. : "The soybean economy of Indonesia"
F.S. WIEBE 1990 - Harward I.I.D.)

4.2.2 : Government policy : GEMA PALAGUNG 2001

According to a study carried out by the Ministry Of Agriculture in 1998 ("Kajian aspek sosial dan ekonomi dalan pengembangan kedelai"), in the 1986–1996 period, harvesting area has increased yearly by 3,18 %, productivity by 1,30 % and production by 4,42 %. During the same period, demand ha increased by 6,86 % yearly, and imports (in volume) by 11,39 % yearly. Soybean demand, according to World Bank (1992) would reach 4,9 million tonnes in 2010, and imports reached 1,3 million tonnes for a demand of 3 million tonnes in 1995 (Vademekum Marketing).

Although these figures are moderatly reliable and conciliable from one source to another, the general trend towards liberalization and its consequences is undeniable.

Indonesia joined GATT in 1995 and exposed its national soybean production to international competition, attempting at the same time to increase production through :

- Productivity increase (intensification)
- Planting area increase
- Yield stability improvement
- Yield discrepancy reduction
- Yield loss reduction.

A survey was carried out in 10 Provinces in order to assess, for each of the points above, the progress that could be expected on a yearly basis.

- Additional production from productivity increase is expected, dominantly from West and Central Java (already above the national average), South Sulawesi and Lampung, for a total of 71 000 tonnes.

- Extension of planting area is expected dominantly from rainfed and lowland areas, with the largest potential in North Sumatra and 1,7 million tonnes expected.

- Improvement of yield stability, through appropiate planting time, water management and pest management could provide 8 500 tonnes, a surprisingly low target.

- Reducing the gap between optimum and actual yields, through better application of research recommendations, could add an extra 150 000 tonnes.

- Reducing yield losses during and after harvest by 50 % would add some 30 000 tonnes.

Total additional production would be expected around 2 million tonnes, with extensification of planting area contributing 88 %. Calculations have been made, in three Provinces (West Java, Central Java, Lampung), in order to assess the profit from improved technology applied by "cooperative farmers" compared to non-cooperators using traditional methods. The additional productivity for every Rupiah invested by cooperators is said to be R 2,5 in West Java, 2,00 in Central Java, and 2,6 in Lampung. As regards the possibility of substituting imports with local production, it is said that, for every US dollar spend on imported soybean,

local production in West Java from non-cooperators would cost 0,98 USD and 0,72 USD for soybean produced by cooperators... Such calculations, which we are not in a position to argue or comment, indicate that "traditional technology" will lead to a negative foreign exchange balance whereas "improved technology" would lead to a positive balance. Comparisons with other crops (maize, groundnut, sweet potato) are, as well, in favour of soybean
(table 8).

Table 8 :
Comparative profit levels in West Java

	Yield (kg/ha)	**Price** (R/kg)	**Income** (R/ha)	**Cost** (R/kg)	**Profit** (R/ha)
Soy (non coops)	1428	1000	1.428.000	740.180	687.820
Soy (coops)	2157	1000	2.157.000	1.030.250	1.126.750
Maize	3184	351	1.118.000	448.417	669.583
Sweet p.	7280	214	1.558.000	761.437	796.563
Groundnut	1133	1329	1.506.000	991.464	514.536

A special movement for the development of food-crops (rice, maize, soybean) through "self improvement" was undertaken in 1998 with the objective to reach self-sufficiency by 2001 (GEMA PALAGUNG 2001). A "special effort" (UPSUS) and a "mass guidance scheme" were launched, based on the new agribusiness joint-venture philosophy. Major contraints to soybean development were once again identified :

1. Poor availability of good quality seed
2. Low pest and disease control
3. Non-optimal use of fertilizer
4. Poor harvest and post-harvest management resulting in high losses and low quality
5. Unavailability of appropriate credit facilities
6. Inefficient extension and farmers support services, resulting in particular from lack of coordination between District Government authorities and Agricultural Services
7. Inappropriate pricing and marketing policy
8. Poor managerial capacity and technical efficiency or farmer groups
9. Lack of involvement of local authorities in the "mass guidance programme" due to competition with other more attractive operations.

Soybean production targets were fixed as follows :

	1999	2000	2001	Growth %
Planting area (ha)	1.692.334	1.762.780	1.789.004	16,4
Harvesting area (ha)	1.607.777	1.674.641	1.699.553	16,4
Yield (t/ha)	1,25	1,25	1,28	0,9
Production (t)	2.000.000	2.100.000	2.173.000	17,3

Operational policy measures have been carried out (or defined) in different fields:

1- Farm credit :

Deleting credit arrears from the 1985-1995 period and rescheduling repayment of debts for the 1995-1997 period, thus giving access to credit for farmers in debt ; credit access and formalities are simplified.

2- Inputs

Subsidized fertilizer will be made available through different channels and not only from rural cooperation credit (KUD). Urea, ClK and Phosphorus (SP 36) will be subsidized.

The companies handling soybean seed (PTP and SHS) could receive soft loans in order to process and distribute soybean seed.

Pesticides, though not subsidized, will be supplied in retailer shops or Rural Cooperation selling points closer to the costumers (farmers or farmer groups).

3- Agribusiness partnership and marketing

Different levels and forms of partnerships have been defined between producers and commercial and industrial operators from simple production contracts to joint operational patterns with technical and financial involvement of the business operators, farmer groups providing

land, inputs and labour, operators providing capital with yearly credit repaid in kind or cash after harvest, based on a selling price fixed with no direct connection with the market price. This type of partnership could be extended to seed distribution, including an improved jabal system.

4- Institutional aspects

Existing institutions will be reorganized in order to develop farmers' sense of sustainability rather than provide assistance.

New institutions will be set up in order to develop mechanization, processing and marketing activities as well as seed multiplication. In the long run, a crop insurance system should be created, in order to protect the farmer from production hazards. Economic management capacity will be developed among farmer groups, based on Presidential Decree 8/1998. Information services will be improved through the Agricultural Extension Information Services (BIPP).

5- Water management

Improved water management will be required in order to increase the cropping intensity to 2 or 3 crops/year, and to improve water use efficiency through better infrastructures and better application of water management technology. Proper monitoring of flooded areas will be developed through creation of water reserves in the rainy season to be used in the dry season, development of pumping capacity and better maintenance or irrigation infrastructures in general.

6- Crop technology

Cropping recommendations proceed directly from research outputs as described in the following chapter. It is interesting to observe what innovations have been introduced (at least on paper) and given priority.

Technology package for lowland (rice field areas) :

- Planting patterns rice-rice-soybean or rice-soybean ;
- Mulching with rice straw or weeds ;
- Recommended variety and improved seed dressed with insecticide ;
- Rhizobium in newly-planted areas ;
- IPM + "balanced" fertilization ;
- Growth hormons, weed control, proper water management.

Technology package for dryland areas, mentioning only topics differing specifically from above :

- Improved cultivation with herbicide use ;
- 300 kg/ha of dolomite ;
- Improved harvest and post-harvest technology ;
- Complementary irrigation in dry season.

(Mulching in the wet areas and insistence upon post-harvest technology, could be constituents of "packages" more open to local technology and adaptive research orientations).

7- Operational strategy

Attention will be given to information and training activities, insisting on economic return and financial incentives of the proposed recommendations. Rural communities, Extension Information Agencies (BIPP), Extension Services, farmer groups will be reorganized and personnel at all levels will be trained accordingly. Farmer groups will receive particular attention and be classified according to their technical capacity and specialization, in view of developping joint-ventures with processors or distributors.

Applied technology will be rehabilitated and oriented towards quality improvement, through all the components of the cropping sequence from land preparation to agro-processing technology including storage and transport.

Inputs and financial services will be improved : better planning and programming is needed in order to provide money and products at the right time and place. Extension seed will be made available through better collaboration between specialized seed growers groups and commercial companies (PTP and SHS). Farm credit system will be adapted to farmers needs and his saving and investment capacity will be improved through better pricing policy and better coordination between Extension Services Cooperation and Bank / Credit Institutions.

(Source : Communication of the Head of Intensification Programme Bureau, Secretariat of Mass Guidance, Ministry of Agriculture, at a workshop on soybean development held in Jakarta, November 30. 1998).

4.3 : Research outputs

4.3.1 : The package of technology concept

Research results will not be analyzed here sequence by sequence, due to the great variety of cropping situations and the absence of location-specific recommendations : the farmer or extension worker, in a given situation, will choose from a number of varieties, fertilizers, chemicals and technologies, and make up his own adaptation of a standard "package of technology".

Official recommendations for soybean production, issued by Research and given in a document dated August 1998, are summarized hereafter ("optimal technology for soybean production" table 9). This "intensive" package (supra insus) can be adapted to "medium" and "low" situations and to different cropping systems (rainfed, irrigated, newly cleared land). Very broad estimates of production costs and benefits, difficult to analyse under present economic circumstances, are given in the same document and presented synthetically in table 10 (inputs and labour requirements) and table 11 (estimated coasts and benefits). All the officers in charge of Research, Extension and Planning that we could meet agreed on the fact that the application rate of these recommendations was low, although not unsignificant if we consider the last reliable figures available (table 12) prior to the financial crisis.

Table 12 :
Inputs utilization in 1993 –kg/ha)

Crop	Fertilizer	Insecticide	Pesticide
Rice irrigated	319	2,62	0,68
Rice non irrig.	113	0,42	0,07
Maize	146	0,13	0,04
Cassava	91,4	1,01	-
Soybean	106	1,49	0,20
Groundnut	79,1	0,27	0,05

Source : CSB and US Embassy, Jakarta

Table 9 :
Optimal technology for soybean production

Irrigated lowland	Rainfed upland
1. Intensification of cropping pattern, from ip = 2 (rice/soy) to ip = 3 (R/R/S/)	1. Cropping rate >2 when possible
2. Land preparation : no-tillage (TOT) or minimum tillage (MOT) after rice	2. TOT land preparation with herbicide
3. Treated seed of improved varieties	3. Treated seed of improved varieties
4. Rhizobium inoculation	4. Rhizobium inoculation
5. Optimal plant population : 400,000 to 500,000/ha	5. Optimal plant population : 400,000 to 500,000/ha
6. Integrated pest management	6. Integrated pest management
7. Balanced fertilization	7. Balanced fertilization
8. When appropriate : liquid fertilizer (N) and growth regulators	8. When appropriate : liquid fertilizer (N) and growth regulators
9. Appropriate water management	9. When possible, complementary irrigation
10. Early weed control	10. Early weed control
11. Improved harvest and post-harvest technology	11. Liming
	12. Improved harvest and post-harvest technology

Table 10 :

Soybean : estimated production costs and benefits

	Rainfed	Irrigated	Newly Cleared
ITEMS (Rupiah)			
. Urea	22 500	22 500	22 500
. SP	35 000	70 000	70 000
. KCL	-	100 000	100 000
. PHT	15 000	15 000	15 000
. Seed	180 000	180 000	180 000
. Inoculant	23 000	23 000	23 000
. Herbicide	120 000	-	-
. Land prep. H	12 000	36 000	36 000
. Drainage/clearing H	-	66 000	36 000
. Herbicide application H	-	-	-
. Planting H	-	-	-
. Irrigation H	-	-	-
. Weeding H	-	66 000	66 000
. Fertilizer application H	24 000	24 000	24 000
. Plant protection H	-	-	-
. Harvest H	36 000	48 000	36 000
. Threshing, transport H	36 000	48 000	36 000
. PBB	7 000	10 000	10 000
. Land rent	175 000	450 000	250 000
. Water	-	30 000	30 000
A - TOTAL COST (Family labour not included)	685 500	1 188 500	934 500
Yield (kg/ha)	900	1 600	1 400
B - GROSS RETURN (rupiah) (1 kg soybean : 2 000 R)	1 800 000	3 200 000	2 800 000
BENEFIT (rupiah) B - A	1 114 500	2 011 500	1 865 500

Source : Min. Agric., 1998

Table 11 :

Soybean factors of production and manpower requirements per hectare

	Rainfed	Irrigated	Newly cleared land
Inputs			
. Urea (kg)	50	50	50
. SP 36 "	50	100	100
. Kcl "	-	50	50
. Sex pheromone PHT (dose)	3	3	3
. Seed	60	60	60
. Inoculant (dose)	1	1	1
. Lime	-	-	-
. Herbicide (dose)	2	-	-
Cultural operations			
mandays hired : H mandays familial : F			
. Land preparation	H2 F2	H6 F2	H6 F2
. Drainage, clearing	-	H11 F4	H6 F2
. Herbicide application	F1	-	-
. Planting	F3	F3	F3
. Irrigation	-	F2	-
. Weeding	-	H11 F5	H11 F5
. Fertilizer application	H4 F2	H4 F4	H4 F4
. Plant protection (PHT)	F2	F2	F2
. Harvest	H6 F4	H8 F4	H6 F4
. Threshing, transport	H6 F4	H8 F4	H6 F4
Total mandays	36	78	65
Land and irrigation			
. PBB (rupiah)	7,000	10,000	10,000
. Rental "	175,000	450,000	450,000
. Water	-		30,000

Source :Ministry of Agriculture, 1998

The package of technology, under intensive, medium and non-intensive crop management systems, was evaluated with 9 new lines and 2 released soybean varieties from 1982 to 1986, under experimental conditions with small plots (2 x 5 m) and statistical layouts. The "intensive" treatment included ploughing, 3 t/ha of stable manure and 75 kg N + 100 kg P2 O5 + 100 K2O, irrigation + insect control as needed. The other two treatments received no ploughing, no mineral or organic fertilizer ; minimum treatment received no land preparation at all. Results are significantly positive in favour of intensification :

	Minimum	Low	High
Mean yield (kg/ha)	798	1066	1964

Source : Sumarno, CGPRT doc.10

Very approaching packages, and similar planting material, were tested in open-field conditions by several operators, among which :

- The Soybean Intensification Experience of the FAO Technical Assistance Co-operation Programme in East Java (1985, reported in "Soybean Research and Development in Indonesia", CGPRT doc. N° 10).

- The Soybean Yield Gap Analysis Project, SYGAP (1992, AARD report) .

It was concluded (in 1992) that the proposed POT was not adapted to the diversity and variability of cropping situations, and did not lead to increases in productivity constant and significant enough to be convincing to the farmer : "... intensification of soybean cropping is quite hazardous as it leads neither to an increased yield sufficient to cover additional costs, nor to a reduction of yield variability to which farmers are very sensitive" (from above-mentioned SYGAP-AARD report page 62). There is no reason to consider that this diagnosis, if true, is not prevalent any more under present day economic conditions.

4-3-2 : Identification of constraints and intensification success factors

A- The above-mentioned FAO project (on line with recent investigations and the conclusions of the National Taskforce for Soybean Enhancement) identified the three major constraints to soybean production in the country as being :

1) The lack of quality seed of improved varieties,
2) The prevalence of pests, diseases and weeds, and
3) The lack of skill and knowledge of the extension workers and farmers in the field of soybean production techniques.

Recommendations for Government action, based on experience gained in the FAO project, were presented as follows :

- Improve access to credit,
- Involve the Government owned seed-companies and the private seed supply network more strongly into the soybean seed production and distribution issue,
- Upgrade the efficiency of the extension network,
- Eliminate, from the POT, the impractical and "high tech" components which draw the farmer's attention away from the more basic issues at hand,
- Stimulate research and development of plant protection techniques and equipment.

B-Bogor Research Institute for Food Crops (Sumaro, 1987, CGPRT document no.10) listed as follows the factors which constrain soybean yield in Indonesia:

- Lack of suitable varieties,
- Seed unavailability,
- Unsufficient land preparation,
- Poor seed stand and crop establishment,
- Unappropriate planting dates,
- Minimal fertilizer use and poor nodulation,
- Water-logging and/or drought stress,
- Pest, disease and weed infestation.

The same scientist (presently Director of the Food Crops Research Institute) listed as follows the technical "key of success factors" leading to soybean intensification (communication presented on the Soybean seminar, Bogor, December 9 th 1998) :

- Determine proper planting time,
- Prepare land adequately depending on soil type and planting time,
- Use appropriate variety,
- Use high quality seed with proper planting rate (400.000 plants/ha),
- Apply fertilizer in accordance with fertility,
- Inoculate on newly-planted land,
- Weed as necessary,
- Maintain moisture at 75-80 %,
- Monitor pests and diseases according to IPM strategy,
- Harvest and apply post-harvest technologies as requested for best quality.

It is acknowledged that many of these factors still need research support, especially in the fields of varietal improvement, seed technology and plant protection.

C - An official document, "Information paper prepared for donor meeting" (1998), presents as follows the constraints that the country has to face in order to speed up the domestic production :

" First the productivity of the existing Seed farms is still relatively below the target. For instance, the productivity of the foundation seed (FS) for soybean in 1996/1997 was 0,47 t/ha, while the target was 0,80 t/ha. In addition, the production of extension seed (ES) of soybean is also far below the requirement. The annual average production of extension seed was about 250 t per year over the period 1994/95 to 1996/97. The figure was only about 0,4 per cent of the total need, while the annual market demand of soybean seed was 5 per cent over that period. This resulted in the disturbance of the continuity of seed supply needed.

Besides productivity, the punctuality of seed supply and the suitability of variety needed, both in terms of amount and quality, are still problems. The just-in-time delivery system of qualified seed, therefore, has become a key factor to succeed the development of soybean production; The application of appropriate technology for soybean cultivation as recommended, on the other hand, is also another key factor.

Other constraints, such as farmer's acquisition of soybean cultivation technology, the availability of capital held by farmer, and farmer perception on soybean crop as a secondary crop, need to improve. Additionally, partnership system to strengthen market institution as well as to guarantee the price of soybean is also urgently needed".

B- **In conclusion** from the above and other sources, and from our interviews with farmers and Research and Extension operators, the common statement is that seed availability, in sufficient quantities and proper quality, is a major constraint to crop extension and improvement. This results from basic characteristics of the soybean plant and from agro-economic conditions which occur in most smallholder production systems under the tropics. There can be no solution to the present problems of soybean production in Indonesia, as summarized hereafter, that would not include a substainable seed multiplication and distribution system adapted to local realities.

a) Soybean is considered a high risk, and therefore low priority, crop because of its susceptibility to pest infestation, disease, water logging and drought ; the farmer is therefore reluctant to invest in costly inputs.

b) Priority given to rice and off-farm employment results in unsufficient manpower and inputs allocation for soybean crop, often relegated on soils and in seasons not appropriate for the plant.

c) The early-maturing varieties used in Indonesia with the objective of growing three crop a year are potentially less productive than the late-maturing types. Lack of fungicide seed-dressing results in poor germination which the farmer tries to compensate by seeding rates much higher than required if the seed was properly dressed.

d) Other negative factors are late seed delivery, unadequate land preparation and uneven seed distribution, poor crop development caused by weed competitors, a wide range of field and storage pests as well as fungal and viral diseases, poor drying and storage conditions resulting in rapid degradation of biological and technological parameters (germinative capacity and percentage of sound, clean, mature seed).

The often-mentionned "unwillingness" and "incapacity' of the farmer to do the work optimally, in our opinion, would deserve closer attention, in regard to his priorities and cropping conditions...The "package" concept should be revised and no more delivered as a receipt for proper soybean husbandry. Recommendations should be given in the form of guidelines to be understood, reasoned and adapted to situation wich vary widely from one field, or farmer, to another : this is valid, as well, for the problem of seed production.

Proposals for research orientations are given in chapter 5.

5 - The seed sector. Proposals for rehabilitation

5.1 : Soybean seed production in tropical smallholder farming systems

5.1.1 : Basic facts and problems

The very strategic importance of the seed issue results from a number of fundamental characteristics of the soybean crop which are not specific to Indonesia :

1) Soybean seed is bulky, fragile, susceptible to a wide range of field and storage pests. It should be handled with care during and after harvest. Its high oil-content, as well as the absence of a natural protection (strong tegument, hull or shell), results in rapid degradation of physical and chemical (acidity, rancidity, kernel integrity) as well as biological (germinative capacity and energy) parameters, especially under temperature and humidity conditions prevailing in wet tropical areas.

2) Recommended planting rates are 400.000 to 500.000 plants per hectare. This results in high seed requirements (minimum 50kg/ha) and a low multiplication rate. The quantity of seed to be preserved from one season to another being important, and seed viability under traditional on-farm storage conditions being inferior to three months, the small farmer meets the greatest difficulty in preserving and renewing his seed capital, if he does not receive appropriate help.

3) Soybean is a dominantly self-pollinating plant. This factor facilitates seed multiplication and preservation of varietal purity ; differentiation between varieties can be made in the field or after harvest, and alien plants or grain can be discarded, as well as diseased or off-type material. Field populations of soybean are composed of a mosaïc of stable types whose heritable characters can easily be carried on from one generation to another and be transfered through selective breeding .

The major problem of soybean seed production, in fact, is not genetic but holds to the fragility of the seed (especially when dry) and to its rapid loss of viability when exposed to heat and moisture. Harvest at good maturity, proper post-harvest handling, careful drying and processing, adequate storage are therefore important

success factors especially in tropical countries, where prevailing economic conditions will often result in low crop return and poor logistics both at farm level and for professional seed operators. The official standards of soybean seed business are then no more applicable and original solutions have to be worked out.

The simplest multiplication system consists in pure seed production, in limited quantities, by Research stations, followed by multiplications carried out by commercial operators or extension services or more often by farmers themselves, who will cover their needs and maintain their own seed capital, with occasional renewal with fresh seed when necessary or when the possibility occurs to change to another variety.

In countries where an extension system can take in charge seed distribution with in-kind repayment after harvest, pure seed provided by research can be multiplied by selected farmers working under contract, at a first stage, and then by whole villages or cooperatives. Their crop is bought entirely and serves as seed in whole areas which are saturated with the same variety. The operation then needs not to be carried out again (if on-farm or village level storage problems can be solved) before a 3-4 year period. This method is seldom satisfactory, for different reasons : the farmer is often reluctant to exchange his entire stock of previous varieties and varietal mixtures will occur ; Roguing is very impopular with "amateur" seed-growers, and off-types will be preserved and pollute the newly introduced variety. New varieties generally have larger grain than the traditional ones, and will be progressively supplanted by the small-seeded varieties with a greater number of seed per unit of weight or volume. Moreover, the farmer will repay his seed-debt with low-quality grain and keep the rest for his own use ; general quality will progressively deteriorate and it may take several years to overcome an epidemic or a climatic accident (drought, flooding).

In sub-tropical countries where traditional smallholding is the rule, it is necessary to maintain a centrally-controlled seed organization, even in situations where farmers can keep seed (or find seed in their neighbourhood) from one season to another. This on-farm seed provision should be renewed with fresh seed of proven quality on a regular basis (by thirds in Indonesian type situations) provided that the farmer be trained and helped to produce and store the rest of his capital. 100 % on-farm seed production would be submitted to important fluctuations and hazards, such as insect and fungal damage, insufficient production, monetary needs that might indulge the farmer to sell his entire crop. On the other hand, regular use of commercial seed is not affordable to the small farmer, and may not always be advisable in low-input cropping systems where the first target is to grow three crops a year and concentrate investments on the dominant food-crop : rice.

5.1.2 : Research outputs for the seed issue

Seed technology, in Indonesia as in many countries of the tropical area, comes under adaptive research and is therefore too often considered by scientists as a "poor relative" to agronomic research in general. Little attention has been given to the basic problems that command the soybean seed issue in smallholder farming systems, from crop husbandry to harvest, proper drying, threshing, sorting, storing and packaging. Most surveys on the problem will include recommendations on the necessity to increase breeding efforts and produce more high breeding varieties expected to answer as many constraints as possible, but few of them (as well as national research programmes) will give proper attention to the technological and organizational gap that lies between "improved" varieties and the actual possibility for the farmer to dispose of adequate planting material. In general, the standards and methods of international commercial seed production, control, testing, certification and marketing, are more or less directly transposed in agro-economic backgrounds to which they are not adapted, and key-in-hand solutions (as well as equipments !) will be recommended. The problem would require a special investigation into the national and regional research systems, at different levels :

A) Crop husbandry : what are the specific requisites, to be included in seed-growers contracts, to produce seed of good physiological maturity, germinative vigor, sanitary state and varietal purity ?
Under present conditions, planting date, appropriate fertilizer, roguing of off-types and diseased plants, proper water management and weed control, harvest at full maturity are minimum requisites. Put aside roguing, which will require special incentive and control, all other topics will result in improved yields, and should therefore be motivating enough for the farmer, especially so if he is encouraged to improve quality through a differential pricing system.

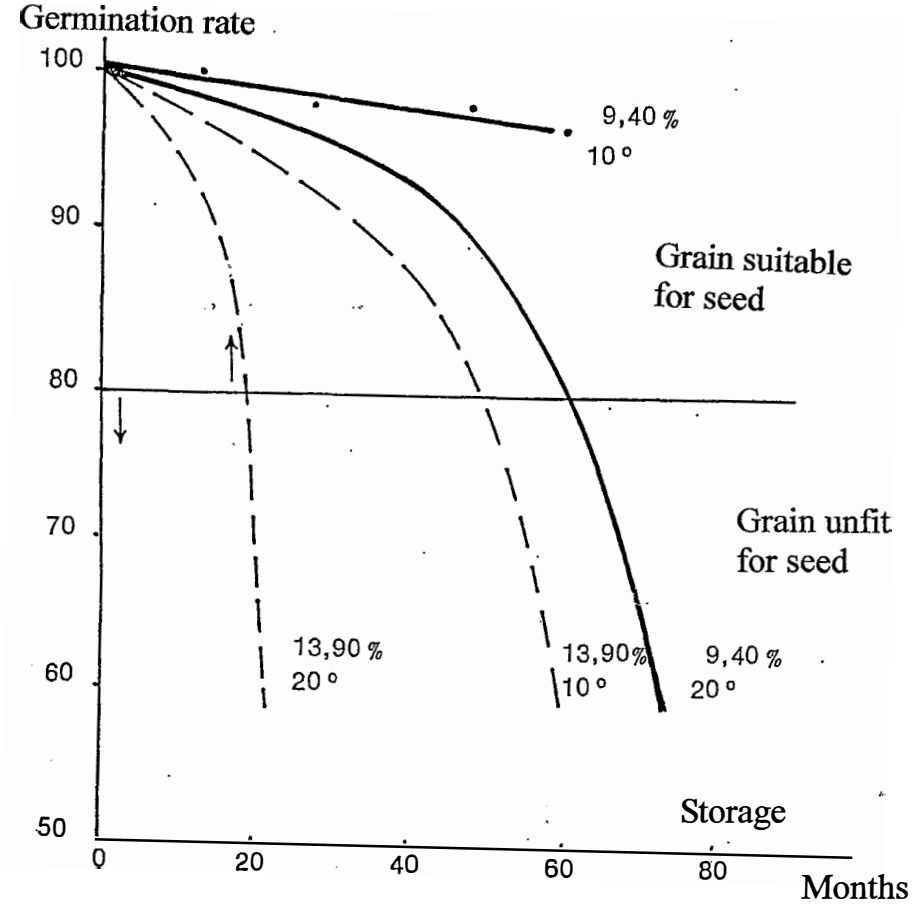
B) Harvest to drying : Harvesting by hand, as done in Indonesia, will prevent seed damage at this stage. Mechanical threshing is a delicate operation, that should not be carried out brutally or too rapidly. Adapted equipment for seed production is seldom available, and threshers of diverse origins will be used for consumer grains as well as for seed. Immature grain, high moisture content at harvest, followed by brutal threshing, are responsible for cracked and splittered grain that will depreciate processing as well as seed value.

The single most damaging influence is high moisture : seeds must be dried to safe moisture levels immediately after harvest and held at a safe moisture content until planted. It is said that for seed of 5 to 14 percent moisture, each 1 percent reduction in moisture approximately doubles seed storage life. High relative humidity affects seed moisture through exchange with the air. High temperature ranks close to moisture as a deteriorative influence : it is considered

that from 0° to 50° C, each 5° C increase in storage temperature halves the seed' s life span (Harrington's "rule of thumb"). For seed kept dry at 11 % and stored between 10 and 20° C seed viability is preserved without risk from one season to another (figure 9).

These observations, made in the USA and France, should be considered cautiously in Indonesia, as soybean will rehumidify very rapidely in ambient conditions and the time interval between end of controlled storage and actual planting is a critical period.

Figure 9 :
Influence of moisture content and temperature on germination rate



Source : CETIOM, France

C) Drying : Soybean seed is ripe for germination at an early stage corresponding to a moisture content of 40 %. Mechanical harvesting and threshing are not recommended (for seed) above 25 % MC and storage requires 11 % MC or less. First stage of drying (from 40 to 25 MC) corresponds to maturation and drying in the field when climatic conditions permit (often less than one week in Indonesia) ; second stage (after threshing) is (or should be) carried out artificially in processing units, respecting the following principles :

- Soybean seed should be dried rapidly ;
- Optimal temperature of drying air is 40°C. Airflow should be rapid (around 1500 m^3 dry air per hour and per m2 of insuflation surface) in order to reduce the drying time ;
- Overheating should be avoided, all the more when moisture content is high;
- Dry preferably in thin layers (50cm) with a high air flow.

In France, recommendations are seed layer 25 cm, drying air initial temperature 45° C, airflow per hour and m3 of grain : 500 to 3000 m3.

Airflow 45°C m3/h/m3 grain	**Germination rate**
500	94
1000	97
1500	94
2000	74
3000	59

Drying can be improved in fluidized seed beds. Following results ara reported by Reztchikov :

Hot air initial temperature	**MC**	**Germination Rate**	**Drying Time (Mn)**
Initial seed condition	20	100	0
40°C	12	97	90
60°C	13	97	45
80°C	12	0	25

D) Storage : storage fungi may attack stored soybean seed of above 9 percent moisture. It is currently considered in Indonesia that storage, unless temperature and moisture-conditioned, is not recommendable for seed beyond 3 months after harvest (this assumption is probably linked to the official guarantee delivered to blue label seed). In fact, "**soybean seed of high initial quality can be safely stored under tropical conditions for nine months at moisture contents of 9,0 to 9,5 percent (50 to 60 percent relative humidity) and temperature of 20 to 25°C**" (B.R. Gregg, Mississippi State University). In areas such as Indonesia, with a dry and a rainy season, good quality seed can be produced in one season for planting in the following one, if properly handled and stored in a cool, dry, ambient environment. Vaporproof packages, such as have been successfully used for groundnut seed in Senegal (West Africa), could be tested on soybean in Indonesia : immediately after harvest, seed are dried to low moisture content, processed and sealed in vaporproof packages (eventually with controlled CO2 atmosphere ; see documentation in annex). Less investment in storage structure is required, and seeds are protected during multiple handling and transit until final utilization at planting time. In all cases, **it would be preferable to improve and prolonge storage, rather than encourage counter-season production which results in low yields of poor seed harvested and processed under rain, or costly and hazardous transfer from one area to another.**

Local technologies, on this matter, should be given more attention : seed, in some areas (Lampung), is stored in air-proof containers with 3 % ash, for several months; polyethylen bags, carefully sealed, are used as well ; success in all cases is a matter of careful drying and low initial moisture content of good quality seed. Promising experimental results have been reported by Hseu in East Java (table 13).

Table 13
Soybean seed germination under different storage conditions (%)

Treatment	Storage duration (month)		
	4	6	14
1- Sealed + lime	95	94	90
2- Sealed + charcoal	96	94	90
3- Sealed + straw ash	98	97	96
4- Sealed only	93	97	90
5- Lime only	96	86	14
6- Charcoal only	97	83	85
7- Straw ash only	97	95	92
8- Non-sealed (CK)	35	0	0

Source : CGPRT Doc N° 10

5.2 : Past and present situation of the soybean seed sector in Indonesia

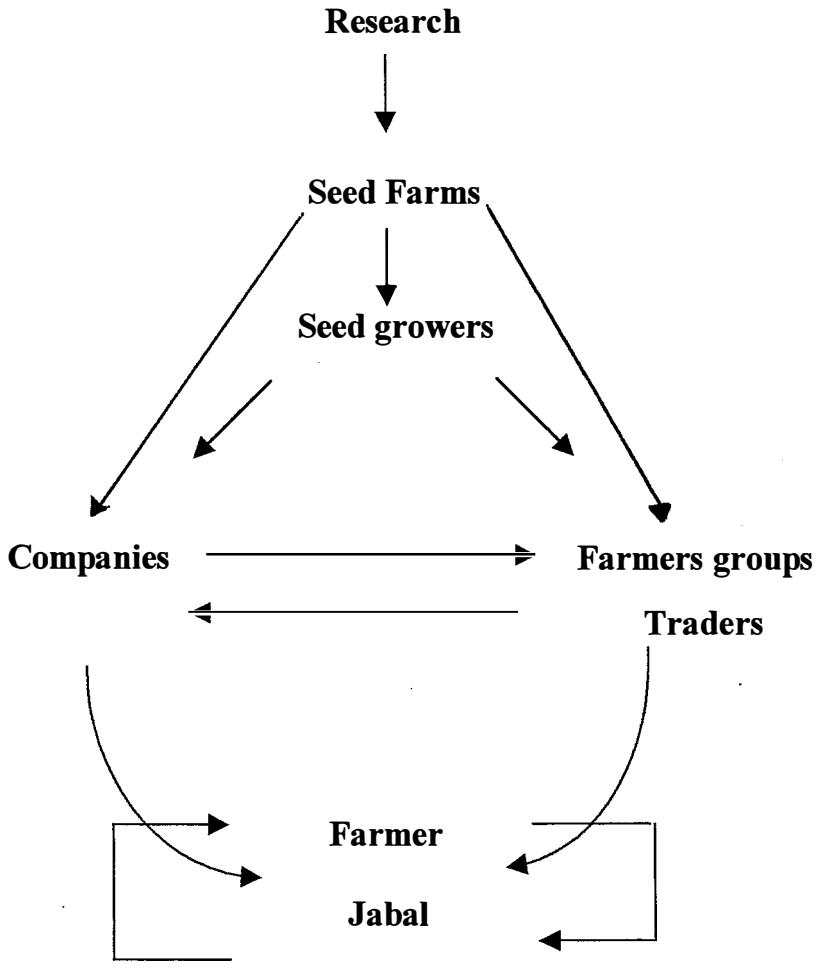
5-2-1 : Principles of seed multiplication

The official seed-flow is initiated with "breeder seed" produced by Research in limited and irregular quantities, with insufficient producer-consumer coordination. This seed is dispatched to BBUs and BBIs, in general poorly equiped, producing successively "foundation seed" and "stock seed", in turn multiplied by specialized farmer groups, in contact with seed companies or on their own, producing "extension seed" for release to the production sector. One or several generations can be carried out for SS and ES levels ("polygeneration flow"). A Seed Control and Certification Service is in charge of supervising seed quality according to official standards, and delivers certificates : "blue label" seed, with 3 months authorisation for sale, meet the highest technological requirements ; "pink label", by far the largest proportion, is in fact bulk seed certified after a rapid check, to be used one month after certification.

Report on the survey carried out in 3 contrasting Provinces (chapter 3) gives an overview of the different operators, public and private, involved in soybean seed production in Indonesia : the institutional sector applies a theoretical genealogical multiplication scheme with successive generations answering particular quality requirements and ending with extension seed, of certified quality, made available to the farmer at a price that he can seldom afford ; the traditional Jabal system is based on exchange or sale of consumer grain to be used as seed, on a season to season or area to area basis, providing around 95 % of the seed capital. In fact, interactions exist between those two systems ; farmers will use as seed and commercial operators will multiply and process as such, whatever they may find at the best quality or price (figure 10).

This situation is not particular to Indonesia. "In most Asian countries, a seed industry capable of supplying quality seed at an affordable price has not yet developed... due to the costs, risks and technical problems of producing soybean seed in the humid tropics... "Susceptibility to deterioration and poor storability of soybean seed under present organizational and technological conditions do not permit supply of improved seed to plant the usual cropped areas, much less maintain stocks... Soybean security stocks can be economically maintained only by producing additional seed beyond present needs... or by collecting the best quality grain for seed use" (Soybean seed production in Asia, P. Wannapee et al., Iowa University).

Figure 10 :
Soybean seed production operations in Indonesia



The official seed-flow, initiating from "breeder seed" provided by Resarch in small quantities, is programmed and organized by a seed production scheme monitored by a Directorate of Seed Development and channelled through " seed farms" specialized in one or several generations, passing on their production, in increasing quantities, from Main Seed Farms to Provincial and District Farms. Each level is submitted to official quality requirements controlled by a Seed Control and Certification Service who delivers certifications or eventually discards if quality is not satisfactory. Germinative capacity of Jabal seed can be occasionally measured, based on irregular testing. Germination is said to be equivalent or slightly inferior, to that of pink label (see figure 11).

In a large-scale sampling operation carried out in East-Java in 1985, average rates of Jabalsim seed were 83,3 % for germination, 2,2 % for damaged seed, 1,31 % for foreign material and 11,31 % for moisture content (source : Nugraha et al., through Provincial Extension Service). In case of shortage, each level can be multiplied successively several years ("polygeneration flow").

The institutional sector, besides upstream seed production, is expected to provide advice, training, and active participation in seed policy.

Figure 11

Soybean seed genealogical scheme and major quality requirements

Operators	Generations	Lab. test requirements (%)			
		Varietal Purity min.	Moisture max.	Foreign material max.	Germination min.
Research	Breeder S				
↓	↓				
BBI Farm	Foundation S	99,9	11	2,2	90
↓	↓				
BBU Farm	Stock S	99,8	11	2,0	90
↓	↓				
BBP Farm	Extension S	99,5	11	3,0	90
↘	↙				
Companies Growers Pink label		99,0	11	3,0	80
↓ ↑					
Farmers Jabal					

5.2.2 : Seed production policy (Repelita VII)

Task-force recommendations and proposed strategy for soybean production increase.

The prospect for crop extension and increase in productivity, answering the official objective of reaching self-sufficiency before year 2001, is based on the figures given on tables 14 and 15 drawn from the national development plan.

Table 14- Proyeksi luas, produktivitas dan produksi kedelai repelita VII

Uraian	Akhir R-VI 1998	Repelita VII					Pertbh/tahum %
		1999	2000	2001	2002	2003	
1.Luas Panen (000 ha)	1.330	1.450	1.600	1.800	1.900	2.000	8,54
2.Produktivitas (Kg/ha)	13,93	15,50	16,50	17,50	17,90	18,20	5,55
3.Produksi (000 Ton)	1.852	2.247	2.640,0	3.150	3.401	3.640	14,63

Table 15- Proyeksi konsumsi dan produksi kedelai dalam repelita VII

Tahum	(Population) Jumlah penduduk Tengah tahunan (000 jiwa)	Konsumi Manusia		Produksi (000 ton)	Plus/minus (000 ton)	Keratangan
		Kg/kap (per capita)	Total (000 Ton,)			
1	2	3	4(2x3)	5	6(5-4)	5
1999	205.932	12,20	2.512	2.247	-265	Kebutuhan Belum Termasuk Untuk Industri Makanen Dan pakan ternak
2000	208.939	12,57	2.626	2.640	-14	
2001	211.943	12,94	2.743	3.150	+407	
2002	214.953	13,33	2.865	3.401	+536	
2003	217.962	13,73	2.993	3.640	+647	
Pertum-Buhan/thn (%)	1,43	3,00	4,47	4.87	2,46	

Datik, desember 97

This very ambitions aim is to be achieved through several directions, as described in a Ministry of Agriculture document entitled "Strategy and measures taken for achievement of target on paddy and secondary crop production" (february 1998) :

- Intensification of cropping pattern from 2 to 3 crops a year ;

- Yield improvement (productivity) of 5,5 % per year ;

- Planted area increase, especially in newly opened production areas, of 8,5 % per year ;

- Special effort on training and operational expenditure (seed, inputs, equipment), expected from both Government and agribusiness.

In 1998-99, production increase was expected from improvement of cropping intensity on 220.000 ha, from yield improvement on 620.000 ha and from new production areas on 257.000 ha ; self-sufficiency was to be achieved the very next year. Crop area calculation scenarios and planting programs by geographic zones, types of intensification and planting seasons were determined accordingly. The general philosophy of this approach is as yet strictly quantitative and bureaucratic, based on arithmetic calculation of needs, yield projections, corresponding crop areas and input requirements, with little attention at this stage to the agronomic and socio-economic feasability of this scheme and to the organisational aspects by which the whole system is to be coherently implemented.

A national seed production tentative strategy

Seed is a compulsory production factor and component of any crop development programme; seed requirements will be directly proportionate to extension and improvement of planted areas and seed availability is among the first objectives to be achieved. An official discussion group has been in charge of preparing a strategy and a development program for soybean seed production and distribution. The report issued late 1998 gives an up-to-date image of the major issues of this reflection :

- The "modern" production system, distributing planting material ("blue label" seed descending from breeder seed of improved varieties and "pink label"), covers less than 5 % of the needs. The rest is provided by the traditional "Jabalsim" system. Both systems need improvement and should be coordinated, with progressive increase of improved seed availability and reduction of the present shortage situation.

- Institutional aspects, even though the system is to be liberalized, should not be neglected : production, processing, quality control, credit, distribution and

marketing, definition of a sustainable policy of price and subsidy, are important and interactive key factors of success and should be State-coordinated.

- Seed requirements are targeted as presented on table 16 :

Table 16 : Area target and seed requirements in 1998-2001

	1998	1999	2000	2001
Planting area (ha)	1.019.170	1.529.615	1.621.050	1.750.526
Seed potential need (t)	50.958	76.480	81.052	87.525
Seed needs (t) "Blue Label"	2.547 (5 %)	7.648 (10 %)	12.157 (15%	17.505 (20%)
Jabal system	48.410 (95%)	68.832 (90%)	68.894 (85%))	70.021 (80%)

- Seed business will be privatized. Government involvement, besides general coordination, would concentrate on research, quality control, information-extension, pricing and subsidy rationale, upgrading the cooperative system and improving the planting material through breeding and adapted seed technology.

- A general multiplication, production, storage and distribution plan will be set up, combining regional choice of varieties, cropping areas and systems, farmer population, planting seasons, credit and marketing organization. Required acreage for seed production and accompanying implements (control, storage, transport, etc..) will be determined accordingly.

- Seed multiplication centers will be created, with participation of contract farmers chosen for their capacity, working with commercial operators. The advantage expected from this approach is the combination of agricultural know-how with entrepreneurship, marketing and management expertice.

5.2.3 : Conclusions on previous findings

It can be concluded that the institutional soybean seed production and distribution system, in Indonesia, is not functioning adequately, for a number of reasons that have been analysed.

Whatever the quality proposed, and "blue label" seed not being convincingling superior to jabal seed from the farmer's point of view, the price issue is determinant. Table 17 demonstrates, from typical figures gathered in South Sulawesi, that seed produced on an average seed farm will cost, before processing and distribution, over twice the price of consumer grain in the same area. It is not surprising, then, that this seed will be used solely by externally financed "Projects" and other State-run operations. No farmer would pay an additional cost of that importance for less than 10 % increase in global germinative capacity. The other alledged or potential yield-improving characteristics of the proposed seed are beyond the farmer's awareness or his practical possibility of agronomical implementation.

It should be reminded that the major constraint met by a previous European-Union funded Palawija Seed Project was already the price of seed : soybean seed was proposed around 20 % above current Jabal price ; this additional cost was too high in the farmer's eye and too low to sustain an official seed production institution. The Project had positive effects in terms of increasing the physical capacity of the institution to produce first generations seed (FS and SS) and to control and certify extension seed, and in terms of improving staff professional knowledge and capacity. These effects are still supporting the institution today, but **it has not been demonstrated that seed production costs could be reduced in the public sector or that palawija seed could be produced and marketed as a self-financing activity in the framework of a coherent policy.** The problem is still posed in the same terms today.

What are the reasons for the E.U. Project not meeting these major targets, and what were the conclusions and proposals of the operators ?

Table 17

Soybean seed production costs per hectare. Seed farms (1998-99)

Labour

Cultivation	375.000 R
Planting	350.000
Mulching	200.000
Weeding	650.000
Harvesting, drying, threshing	750.000
Packing	150.000
Sub-total	*2.475.000*

Inputs

Seed (40kg)	220.000
Usea 100 kg x 450 R	45.000
SP 36 50 x 675	33.750
Clk 50 x 2000	100.000
Growth regulators, N (liquid)	140.000
Insecticide	560.000
Bags	302.000
Rodenticide	70.000
Storage fungicide	80.000
Sub-total	*1.551.250*

Other costs

Transportation	75.000
Certification	80.000
Administration	125.000
Sub-total	*4.306.250*

Good seed yield : 1000 kg/ha
Production cost : 4306 R/kg

(Source : Provincial Extension Service, South-Sulawesi)

The Commission of the European Community final report by the team leader (April 1997), corroborated by Indonesian participants to the Project, interviewed in December 1998, is very interesting and deserves careful consideration before new decisions are taken. It is clearly mentioned that :
" profitable crops for seed enterprises are those for which hybrids were or can be developed. In general these are crops of which the farmer himself cannot (easily) produce and store seed. Except for maize hybrids, seed of all palawija crops under the Project can easily be saved by the farmer from his own grain crop" (pp.61-62)

"It is strongly recommended that public authorities recognize the important role farmers can play in developing the national seed sector, and that farmers' participation will be actively sought in all seed related activities" (p.64).

" The very high minimum (soybean) seed quality standards in force in most developed countries, bear no relationship to benefits from these to the (Indonesian) farmers. Rather they are the results of competition between seed companies, and the development of technology that makes attaining these standards feasible. Seed produced by farmers themselves does not meet these high standards and it has come to be assumed that therefore the crop performance of their seed should be inferior" (p.77).

"Almost all unlabelled seed in NTB and E-Java appears to meet the pink label standard of 70 % *(80 %)* while 70 %
of such seed meets also the ES standard of 80 %. In general, unlabelled seed in those provinces shows a germination equal or even better than ES" (p.79).

"The germination of unlabelled seed is equal to that of certified seed, and the latter is only superior in varietal purity, which at present does not seem to interest farmers very much. The JABAL system should therefore be allowed to continue supplying the bulk of commercial seed. If proven desirable to increase overall varietal purity of this seed, a small annual infusion of subsidized ES seed and/or careful roguing of key farmer' fields would probably be adequate to achieve this " (p.87).

We fully agree with this statement, only regretting that is has not been made prior to Project definition and implementation, rather than ex post. We would moreover recommended not to neglect the importance of the institutional operators. An efficient soybean seed organization requires god coordination between a State-managed institution in charge of sustaining seed quality, and a deconcentrated network of seed growers producing bulk seed under control of Extension Services, with periodic renewal of planting material as proposed hereafter.

5.3: Orientation proposals for rehabilitation

5.3.1 : Basic orientations and principles

A)- The present principles of seed multiplication in Indonesia, including participation of multiple public and private operators with centralized production of first generation seed under State control, should be maintained. Recommendations of official task-forces on soybean seed production should be given careful consideration. Lessons should be drawn from previous projects and their findings included into future decision-making proposals.

B)- Vertical coordination of diverse participants in the seed system, belonging to different State departments, with different motivations (scientific, commercial, developmental), should be improved in order to make offer and demand of soybean seed meet more efficiently in the framework of a coherent plan of action. This plan, at a first stage, would be implemented through a **5-year inception project, limited to a particular area or Province, with progressive and practical extension of findings to other areas.**

C)- Involvement of Seed Farms would be limited to first generation seed (Foundation and Stock), and their facilities (including multiplication fields) be thoroughly rehabilitated. They would interact with Research and with the Project in the fields of multi-locational varietal testing and adaptive research in the sector of post-harvest seed technology.

D)- Involvement of private companies would not be limited to processing and sale, but be extended to production of Blue Label seed in collaboration with specialized Farmer Groups operating under contract and under close control of CCCS. Production price of BL should be reduced accordingly, and Companies (with research support) should improve their storage facilities and develop appropriate packaging technologies (vaporproof bagging) in order to prolonge seed viability beyond 3 months.

E)- A special multi-disciplinary seed production and distribution research programme, would be defined and implemented. Research action and field demonstrations would include the other operators of the sector at all steps of the seed sequence, from varietal testing to full-scale storage, both collective and individual. Special attention would be given to quality improvement and incentive through differential pricing, and to a clear assessment of the yield increment that can be expected from the use of improved seed. An adapted seed cropping and post-harvest conditionning system should be defined at farm or farmer group level, conducing to on-farm seed production and storage from one season to another.

F)- Soybean farmers would be encouraged to form Soybean Farmer Production Units, operating within existing organizations, as observed in the Provinces visited. They would take in charge last generation seed multiplication, with Extension support, and plant their own seed the following season, one-third of their seed capital being renewed every year.

5.3.2 : Seed multiplication options

The following calculation standards have been adopted for the proposed multiplication schemes :

- Average good seed yield : 1,0 t/ha.
- Average seeding rate (considering losses, diversion,drying) : 70 kg/ha.
- Practical multiplication rate : 15.

In the case figure of a 100.000 ha potential area, representing approximately the production capacity of Tenguru islands or one third of East Java, seed requirements at farm level would be 7.000 t/year. Multiplication schedule is then given in table 18, based on the option that last generation seed would be produced and stored by the farmer himself, and seed purchase reduced to 7 percent of his requirements (option 1).

Table 18

Seed multiplication schedule for a 100.000 ha area. Option 1.

Multiplication Level	Breeder	Foundation	Stock	Extension	Farmer
Principal Operator	**Research**	**S.Farm**	**S.Farm**	**Seed Grower groups Companies**	**Farmer Production Units**
Year (n-4)	140				
Year (n-3)	140	2,1			
Year (n-2)	140	2,1	31		
Year (n-1)	140	2,1	31	466	
Year n onwards	140 kg	2,1 t	31t	466t	7.000t

(Round Figures)

Polygeneration flow (2 or more generations for each level), or growing 2 crops/year, are possibilities not considered in the theorical scheme presented table 18. It appears clearly that any provisional modification of seed demand should be scheduled well in advance, specially for the commercial operators (seed grower groups and companies) who will have to handle large quantities.

If the quantities involved by option 1 were considered too important, another system (option 2) could be to provide the farmers with the seed quantity necessary to be multiplied in year (n-1) in order to cover one-third of their needs in year n, the rest being re-multiplied or provided through a jabal collective seed-stock which would thus be systematically rejuvenated. Different forms of Farmers Groups have been encountered in the Provinces visited ; Soybean Farmer Production Units (SFPU), operating independantly or within existing credit or cooperative organizations, could be created and include, among their activities, on-farm individual or semi-collective seed production, following the scheme presented table 19. They would receive training and support from Extension and be provided with elementary facilities such as tarpaulins, fungicides, air-tight bags; threshers (if not already available) could be hired and credit facilities could be provided for construction of adapted village stores.

Table 19

Seed mutiplication schedule for a 100.000 ha area. Option 2.

Multiplication Level	B.S.	F.S.	S.S.	E.S.	Farmer S1	Farmer S.2
Principal Operator	**Research**	**S.Farm**	**S.Farm**	**Seed Grower groups Companies**	**SFPU**	**SFPU**
Year (n-5)	3,2					
Year (n-4)	3,2	48				
Year (n-3)	3,2	48	720			
Year (n-2)	3,2	48	720	10,8		
Year (n-1)	3,2	48	720	10,8	160	
Year n onwards	3,2 kg	48 kg	720 kg	10,8 t	160 t	2400 t

(Round figures)

In the case figure of 100 farmers running 80 ha on an associative basis, 130 kg/year of good quality extension seed, provided by the institutional system, would be multiplied twice by the farmers themselves in order to secure and manage directly at least one-third of their soybean seed capital (1,9t/year for 80 ha planted) :

- **100 farmers** ⟶ **80 ha/year**
- **70 kg seed/ha** ⟶ **5,6 t seed/year**
- **1/3 seed capital to be produced by SFPU on year n (19 kg/farmer, 24 kg/ha)** ⟶ **1,9 t seed/year**
- **Certified seed to be provided on year (n-1) and multiplied by SFPU (1,3 kg/farmer, 1,6 kg/ha)** ⟶ **130 kg ES/year**

Intermediate options are of course possible, the principle being that farmers themselves take in charge partly or totally the last generations of seed multiplications, either on their own farm if the storage problem is solved, or from another area through an organised and reenforced jabal. This system would require less certified seed investment from Research, Seed Farms and the Commercial sector, and a greater participation of the farmers themselves, as "polygeneration flow" of the last generation is in fact taken in charge by SFPUs supported by Extension.

This would require a considerable effort of programming, coordination and especially training and logistic support in favour of SFPUs. **Financial support of the State would be thus utilized more adequately in favour of the soybean producers themselves, including those specializing in unlabelled or labelled seed production, rather than in exclusive support of the institutional sector to which much attention, with little result, has been given by previous Projects neglecting on-farm or jabal seed production.**

It should be reminded moreover that the economic context is not favorable to full-price commercial seed utilization, and that research results to date do not indicate any significant incremental effect of certified seed on global soybean productivity. Priority, therefore, should be given to improve logistics and organization, rather than trying to meet with standards of seed multiplication and commerce inadapted to the technical needs and financial capacity of the Indonesian soybean producer, processor and consumer.

Farmer participation in seed production would have another advantage : the "technical package" for seed production is not fundamentally different from the one recommended for soybean in general. Good soybean seed, as required by the Indonesian farmer, is before all sound, mature, regular whole grain ; those will be viable if monitored and stored properly and will procure high yields. "Varietal purity" of a variety such as WILLIS (70 % of total acreage) is not very meaningful in terms of yield improvement potential, as the variety is in fact a mixture or a blend of 50 lines, as shown by the work of JICA scientists ! A soybean seed multiplication sector thus managed by the farmers themselves, applying improved technologies, dispersed in the production area rather than concentrated in specialized and costly seed-farms, would constitute an excellent benchmark and demonstration medium for in-field testing and confirmation of research results, while reducing considerably the price of seed.

5.3.3 : Implementation measures

Option 2 meets the minimum requirements in order to sustain a seed multiplication system ; anything below the proposed seed renewal rate (1,6 kg/ha/year) would result in rapid varietal dilution.This low rate requires to be supported by an efficient organization coordinated with a reenforced jabal system integrated in the

seed flow and advised by Extension agents and BPTP. Implementation of the chosen option should include

- Definition of a work plan and institution of a vertical coordination unit including representatives of all operators involved, from Research to Seed Grower groups and SFPUs ;

- Identification and definition of a 5 year project in a well-chose location ;

- Rehabilitation and augmentation of Seed-Farm production capacity (land rehabilitation, equipment, storage facilities, training) and seed-lab testing and control capacity ;

- Support to farmers : organization of on-farm seed production within the jabal system, adapted credit facilities, supply of small equipment : tarpaulins, bags and seed-containers, hand-threshers.

Adaptive research will be a determinant factor of success at all steps of the seed commodity sequence, as described in paragraph 5.1.2 "Research outputs for the seed issue". A practical 5 years experimental programme, conducted by a Seed Multiplication and Distribution Project in close collaboration with institutional Research and BPTP, under responsibility of a technologist, could include the following topics :

a)- Contribution to location-specific breeding programmes through multi-locational varietal testing ;

b)- Measure of carry-over effects of heavy fertilization on high-income crops preceeding soybean (hybrid maize) ;

c)- Develop a fungicide seed-dressing treatment, compatible with rhizobial inoculation, in order to save seed and obtain better stands under limiting soil moisture conditions at planting ;

d)- Contribution to the agro-economic assessment of the soybean technology package with special regard to seed quality components (substractive tests and interaction measures between components) ;

e)- Definition of a seed-grower contract, including basic crop husbandry as well as specific seed production operations (roguing for off-types and seed-borne diseases) ;

f)- Adapt a simple thresher, with rubber instead of rigid operating parts, that will avoid damaging fresh soybean seed ;

g)- Calibrate precisely rice dryers utilized for soybean drying in Seed Farms; elaborate a simple dryer or drying method to be used for collective drying of soybean seed by seed growers or SFPUs ;

h)- Develop an adapted on-farm or collective storage method, combined with proper drying, in order to keep seed for the necessary time (3 to 9 months) : explore and test local and imported available technologies (air tight jerricans and polyethylen bags, vaporproof or vacuum-packaging, etc...).

i)- Determine and adapt the best calendar for local seed production, in such a manner that harvest and post-harvest operations will coincide with the dry season, and organize the entire cropping sequence accordingly ;

j)- Develop a rapid germination test (4 days instead of the 7 days standard International Seed Testing Association test), applicable directly in field conditions ;

k)- Definition of rapid sampling and testing methods in order to asses the seed value of a crop and determine the price accordingly (quality categories and differential marketing pricing systems).

6- The groundnut issue

6.1 : General crop and market presentation

(see chapter 2 and annex for major economic aspects)

Groundnut is an annual legume widely grown in areas ranging form 40° N to 40° S. The nuts are either crushed for oil or eaten directly in a variety of forms ; haulms and oilcake are valuable by-products. This hardy and adaptable crop, with its many uses, is popular in tropical areas and about 87 per cent of world production is consumed domestically. Only around 13 per cent is traded internationally, as kernels (shelled or unshelled), oil (crude or refined) or oilcake. Groundnut 's high content of edible oil (50 per cent) and protein (25 per cent) make it a popular and valuable human food, especially in developing countries where diets often consist mainly of low-protein cereal foods.

Today, nearly all the international trade in shelled or unshelled groundnut is destinated for use as human food, oil being processed mainly in the producer countries (table 20). "Edible" groundnuts are intented for human consumption as whole or processed nuts, without the prior extraction of the oil. Shelled nuts represent the first stage of processing and account for the bulk of transactions. Unshelled nuts, when processed for a demanding market, will be sorted for size, shape, pod integrity ; shelled nuts are subject to more rigorous processing operations that lead to the different products available on the market. Between the so-called edible groundnut (in the narrow sense) and the oil groundnut, there exists a range of intermediate types, which often cannot be distinguished from one another except by their end use. This is particularly true of the traditional domestic market, in producer countries, where most operators simply sort out the largest nuts before grading and processing them for direct sale. The international market, which is both more demanding and more rewarding, is based on improved varieties and cultural techniques developed by plant breeders and agronomists. These are used to make a range of products meeting strict quality standards, as presented in the following section.

Table 20

Groundnut utilization by type and region (in-shell equivalent, '000t)

	Total availability	Confectionery	Processing[1]	Other uses[2]	Per caput food supply (kg per year)
1979-81 average					
Developing countries	16,005	4,556	9,187	2,262	1.4
Africa	3,937	1,382	1,699	855	4.6
Asia	10,855	2,918	6,649	1,288	1.1
Latin America and the Caribbean	1,008	196	735	77	1.1
Developed countries	2,466	1,528	808	129	1.3
Australia	41	33	5	3	2.2
CIS[3]	74	54	18	2	0.1
Europe (EC)	577	247	327	2	0.5
South Africa	243	37	177	29	1.3
USA	1,204	889	233	82	3.9
World	18,472	6,085	9,995	2,392	1.4
1989-91 average					
Developing countries	20,644	6,441	11,521	2,689	1.6
Africa	4,341	1,538	2,008	795	4.0
Asia	15,495	4,561	9,127	1,806	1.2
Latin America and the Caribbean	621	263	299	59	1.0
Developed countries	2,714	1,913	656	145	1.5
Australia	48	40	5	3	2.4
CIS	111	81	23	6	0.1
Europe (EC)	579	410	164	3	0.9
South Africa	108	14	80	15	0.4
USA	1,489	1,054	322	113	4.1
World	23,358	8,355	12,177	2,835	1.6
1994-96 average					
Developing countries	26,956	9,024	14,442	3,511	2.1
Africa	6,011	1,999	2,670	1,342	4.4
Asia	20,062	6,629	11,360	2,073	1.4
Latin America and the Caribbean	606	251	316	57	0.9
Developed countries	2,746	1,825	769	153	1.4
Australia	41	34	4	3	2.0
CIS	11	0	9	2	0.0
Europe (EC)	589	390	196	3	0.9
South Africa	144	14	116	13	0.3
USA	1,477	950	401	126	3.6
World	29,703	10,850	15,211	3,663	1.9

1. Processing is largely into oil and meal, and very small quantities for industrial products

2. Other uses include feed, seed, and waste

3. Commonwealth of Independent States of Eastern Europe. Until 1991, area of the former USSR

Source: FAO

Comparison of groundnut and soybean markets shows superior income from groundnut, especially in the form of shelled, graded kernels :

Market prices, June 1999

- **Kernels** (shelled) : groundnut, lowest grade (60/70 grains per ounce) : 710 USD/t ; highest grade (38/42 grains per ounce : 910 USD/t
  Soybean, US N° 2 : 191 USD/t (no quoted transaction for higher grades)

- **Oil** : groundnut, 750 USD/t
  Soyabean : 390 Euro/t

- **Cake** : groundnut, 132 USD/t
  Soyabean : 141 USD/t

Source : Marchés tropicaux et méditerranéens

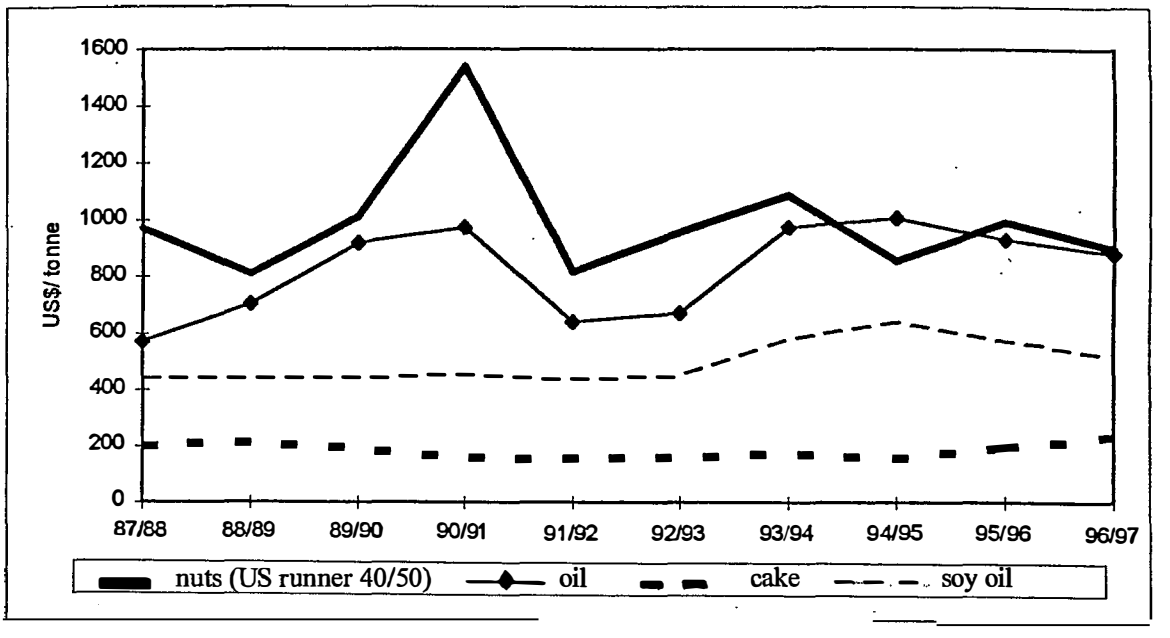
6-2 : Edible nut production

The lucrative export market for edible (confectionery) groundnuts is very demanding in terms of its quality requirements. The price of high-quality edible groundnuts is, on average, twice that of groundnuts for oil production (figure 12). The latter face stiff competition from other oilseeds, including soybean, rape and sunflower, whereas edible groundnuts are increasingly taking the place of the more expensive edible nuts, such as cashew, almond and hazel. The higher value of edible groundnuts can benefit everyone in the subsector, particularly farmers. This is especially true in countries that are already large-scale producers of groundnut for oil production, where moving into edible groundnuts is the easiest and most obvious form of diversification. In addition, adding value to edible groundnuts by shelling, grading and sorting them generates income and jobs, particularly in rural areas.

Besides boosting exports, edible groundnuts can also be sold on the local domestic market, which often imposes somewhat less strict quality standards (Kacang rebus in Indonesia). Developing countries with high rates of urbanization and income growth have rapidly expanding domestic markets. Many Asian countries already fall into this category, among which Indonesia, who could produce its own consumption instead of importing it at high cost (see annex).

Countries importing groundnuts impose strict specifications on the product. These cover size, an important consideration where further processing is required, and various quality standards aimed at creating a safe, appealing product that is robust enough to withstand transport and processing. In addition, there are differing consumer preferences in different countries. International trade in edible groundnut applies closely defined size criteria to determine the different categories marketed (table 21). All the categories shown in the table can be exported either unshelled or as shelled, sorted and graded nuts (hand picking selected or HPS). In either case they will be consumed after processing of various kinds, into roasted peanuts, coated nuts, nougeat, sauce, butter and so on.

Figure 12
Edible groundnut prices compared to other products (CIF Rotterdam)



Source : OIL WORLD, 1997

Table 21
Edible nuts : technical standards

Botanical type	USA Classification	Kernels or pods per 100g	Number per once (grade) 1oz = 28,35g
	Pods		
Virginia		56/63	16/18
		49/56	14/16
	Fancy	45/49	13/14
	Jumbo	35/42	10/12
			8/10
	Kernels		
	Extra large	98/112	28/32
	Medium	112/141	32/40
	N° 1	158/194	45/55
	N° 2	176/211	50/60
Runner[1]	Kernels		
	US N° 1	158/194	45/55
	Medium	141/158	40/45
	Jumbo	123/141	35/40
Spanish	Kernels		
	N° 1		50/60
	N° 2	211/246	60/70
		246/282	70/80

[1] Medium-sized varietal type (40/55 kernels / oz)

"Demand for groundnut for direct food consumption increased by 80 % between 1979-1981 and 1994-1996 (table 19). Developing countries, among which Indonesia, accounted for much of this increase : utilization of confectionery nut nearly doubled in these countries, and their share of global utilization increased from 75 to 83 percent. Asia now accounts for two-thirds of global utilization" (The world groundnut economy – ICRISAT 1999).

6.3 : The Indonesian situation

Groundnut production is an important issue for Indonesian agriculture and economy, with increasing acreages and demand but stagnant yields :

	Area	Production	Yield	Per caput Supply
Indonesia 94-96	691.000 ha	1.073.000 t	1,6 t/ha	
Growth rates % year				
• **Indonesia 79-96**	2,5	2,5	-0,1	2,0
• **Asia 79-96**	1,5	4,0	2,5	1,4
• **World 79-96**	1,3	3,2	1,9	1,7

Source FAO

Indonesian imports of groundnuts, although lower in volume, reach (or exceed) the value of soybean imports : groundnut imports, in the form of oil or confectionery nuts that could easily be produced in the country, are an important source of currency loss for Indonesia (table 22)

Table 22

1996 imports : .000t and million US dollars

	Grain			Cake	Oil	Total
	In pod	Shelled	Roasted			
Volume	-	746	-	962	-	1687
S.bean *Value*	-	452	-	266	-	718
Volume	3	162	121	70	325	683
G.nut *Value*	4	117	194	166	374	855

(855 millions dollars = 2,14 trillion Rupyah)

Source : CBS

Groundnut crop husbandry in Indonesia is entirely traditional, with practically no improved seed, fertilizer or crop protection. Seed traders, in West Sumatera, will occasionaly process nuts bought directly from producers and sell its as seed to Government Projects (annuals interplanted in young plantations of perennials). Two varietal types are currently used :

- 1 to 3 grains per pod, whitish valencia type (Kelinci) ;
- 2 grains per pod, pink, small, spanish type (Gajah)

Farmers will either produce for their own consumption, or sell to traders, or produce seed for sale through the jabal system. The crop is considered easier than soybean (pest and disease incidence is lower), soil fertility requirements are lower, seed multiplication rate is lower (around 10 versus 15 for soybean) but there is little storage problem for seed kept in pod and shelled at the last moment before planting. Marketing is no problem due to high demand, but price seasonal fluctuation is high as consumption is linked to traditional feasts.

Small processors (often of chinese origin) will buy from traders directly after harvest, and will decorticate, blanch, grade, all by hand, and process into a large range of products, sold in their own shops. Preference goes to local production (small-seeded spanish or valencia types, considered more crispy and tasty) rather than to the large-seeded virginia types imported from Thailand. The trading and

processing network is very similar to the soybean commodity network, but the range of products roasted, boiled, sweetened, salted, incorporated into candies or cakes is much more diversified.

Crop development could probably be undertaken with success, with a better cost/return ratio than with soybean, as groundnut production in Indonesia presents many advantages :

- The economic background is favourable : international prices of confectionery nuts are high and increasing ; on the other hand, requirements of costly imported inputs are much lower for groundnut than for soybean.

- Fertility and fertilizer requirements are low. Groundnut can be grown on light, exhausted sandy loams, as well as on heavier soils as long as compacity can be alleviated by irrigation at the proper time (peg penetration and harvest).

- **Local market is more diversified than the soybean market, preference goes to local production, shelf life of groundnut products is much longer than that of tahu and tempeh, and home consumption is much easier through direct consumption (raw or cooked) or incorporation into dishes and meals.**

- Groundnut is drought tolerant and can be grown in rainfed conditions or uplands areas.

- Pest and disease pressure are much lighter on groundnut than on soybean.

- On-farm seed production and storage are made easier by the presence of a protective shell, although seed requirements per land surface are higher than for soybean.

- Groundnut crop is familiar to Indonesian farmers. Processing could be easily handled by the producer himself (shelling, cleaning, hand-picking) and by the existing network of small processors (blanching, roasting, cottage-industry transformation).

Crop improvement could be expected from :

- Introduction of improved varieties : drought tolerant, dormant, early-maturing types, combining crispness and large grains, could be imported from asiatic or african sources ;

- Yield improvement through fertilization in rotation with a high-yielding cereal crop (hybrid maize) ;
- Improvement of on-farm seed production (storage) and use (fungicide seed-dressing before planting) ;

- Improvement of post-harvest technology, from field drying to proper storage in order to sell when prices are high ;

- Better knowledge of the plant and the market through training, expert consultancies and a specific research and development programme.

Technical support can be requested from :

- The groundnut team of CIRAD, the French institution in charge of tropical agricultural research for development ;

- The Peanut CRSP (Cooperative Research Support Programme) from the USA, a University-based network for specialized training and commodity research ;

- ICRISAT (International Crops Research Institute for the Semi Arid Tropics), the international center with a mandate on groundnut research .

Addresses, more precise information and possibly terms of reference can be provided on request by the consultant.

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ANNEXES

- Indonesian exports and imports
- Soybean market indicators
- Statistical date : prices (Rupiah)
- South Sulawesi production areas
- South Sulawesi : Jabalsim circuit
- Jabal seed quality in East Java
- Groundnut area, yield and production
- Groundnut growth rates
- Groundnut regional economy
- Documentation on vacuum or air-controlled packaging

EXPORTS OF INDONESIA IN TONS (FAO)

Item	1990	1991	1992	1993	1994	1995	1996	1997	1998
CORN									
Bran of Maize	0	1 524	2 553	2 197	20	125	379	582	514
Cake of Maize	0	0	0	0	0	0	654	17	0
Flour of Maize	0	0	19	38	1	2	1	20	9
Germ of Maize	0	0	0	0	0	0	0	2	0
Green Corn (Maize)	3 095	555	235	26	88	141	0	0	0
Maize	141 835	33 223	149 695	60 837	37 441	79 144	26 830	18 957	624 942
Oil of Maize	0	72	1	16	3 500	452	14	0	3 000
RICE									
Bran of Rice	33 842	20 883	25 891	27 527	2 932	15 959	8 991	10 366	15 225
Cake of Rice Bran	569	50	2 653	160	0	0	0	0	0
Milled Paddy Rice	0	0	42 391	342 599	160 236	2	184	53	44
Rice	1 911	643	42 492	350 606	169 141	5	197	64	1 981
Rice Flour	1 984	546	488	337	467	539	513	0	1 422
Rice, Broken	1 846	643	0	8 000	50	1	13	1	0
Rice, Husked	0	0	100	1	5	2	0	10	1 900
Rice, Paddy	100	0	1	9	13 616	0	0	0	57
SOYBEAN									
Cake of Soya Beans	2 000	4 512	0	0	0	0	1 045	3 702	545
Oil of Soya Beans	29 453	21 428	23 970	37 591	25 829	8 753	4 197	28 048	47
Soya Sauce	129	401	1 040	1 265	1 315	1 549	2 964	2 454	826
Soybeans	240	265	3 911	746	31	83	240	6	0
GROUNDNUT									
Groundnuts in Shell	327	171	696	1 251	2 532	2 711	3 235	2 559	3 338
Groundnuts Shelled	0	49	20	0	33	49	110	236	1 502
Groundnuts Tot Shd	229	169	507	876	1 805	1 947	2 374	2 027	3 839
Oil of Groundnuts	0	0	0	36	0	0	0	0	1
Peanut Butter	228	216	59	5	20	3	0	0	0
Prepared Groundnuts	1 172	1 116	2 800	1 083	1 158	992	1 588	1 229	1 491

IMPORTS OF INDONESIA IN TONS (FAO)

Item	1990	1991	1992	1993	1994	1995	1996	1997	1998
CORN									
Bran of Maize	494	870	42	1 262	300	123	1 813	1 515	34
Cake of Maize	0	0	0	0	0	0	1 682	0	0
Flour of Maize	2 432	3 141	2 613	3 420	3 622	5 697	2 010	2 348	2 233
Germ of Maize	0	0	0	0	0	1	106	21	1
Green Corn (Maize)	0	0	5	0	0	1	0	0	0
Maize	9 050	323 262	55 876	494 470	1 118 284	969 193	616 942	1 098 354	313 463
Oil of Maize	768	1 044	910	773	1 198	1 615	1 403	1 321	2 395
RICE									
Bran of Rice	171	17	0	198	15	18	9 307	2 222	5 084
Milled Paddy Rice	40 641	169 033	585 791	4 743	271 802	1 309 510	2 040 203	10 950	1 793 907
Cake of Rice Bran	0	2 573	0	265	3 085	10 470	0	0	0
Rice	49 577	170 993	609 772	24 318	630 073	3 157 700	2 149 757	348 075	1 894 958
Rice Fermented Beverages	18	12	15	29	6	3	1	0	0
Rice Flour	16 193	18 580	9 331	7 780	545	756	52	26	289
Rice, Broken	7 023	1 735	18 255	14 166	350 625	1 819 650	89 828	146 523	67 936
Rice, Husked	1 913	225	2 151	5 408	2 120	27 857	19 726	187 618	32 815
Rice, Paddy	0	0	5 500	1	8 502	1 051	0	4 591	461
SOYBEAN									
Cake of Soya Beans	5 252	193 349	170 631	361 065	498 592	681 875	942 292	868 790	668 412
Oil of Soya Beans	1 639	3 128	2 342	3 048	1 244	3 124	11 373	38 268	18 785
Soya Sauce	690	846	562	585	505	455	1 290	1 145	675
Soybeans	541 060	672 757	694 133	723 864	800 461	607 393	746 329	616 375	343 124
GROUNDNUT									
Groundnuts in Shell	319	1 609	500	0	0	2	1 211	16	362
Groundnuts Shelled	49 769	94 608	54 892	108 097	150 902	148 853	161 951	170 778	41 312
Groundnuts Tot Shd	49 992	95 734	55 242	108 097	150 902	148 854	162 799	170 789	41 565
Oil of Groundnuts	18	4	4	2	19	25	43	4	2
Peanut Butter	281	144	73	72	49	108	0	0	0
Prepared Groundnuts	19	187	217	152	44	45	122	256	79

Soybean market indicators in Indonesia (tonnes or specified units)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Acreage (ha)	732 346	809 978	607 783	639 876	858 854	896 220	1 253 767	1 100 565	1 177 360	1 198 096	1 334 100	1 368 199	1 665 706	1 407 000	1 477 000	1 280 000	1 180 000	1 145 000
Production (tonnes)	652 762	703 811	521 394	536 103	769384	869 718	1 226 727	1 160 963	1 270 418	1 315 113	1 487 433	1 555 453	1 869 713	1 555 000	1 680 000	1 517 000	1 400 000	1 360 000
Yield (tonnes/ha)	0,891	0,869	0,858	0,838	0,896	0,970	0,978	1,055	1,079	1,098	1,115	1,137	1,122	1,105	1,137	1,185	1,186	1,188
Losses ans seed use	118 830	114 846	94 561	107 275	137 137	167 055	202 235	198 184	212 355	224 519	246 902	269 940	294 716	260 450	265 600	241 040	225 250	220 450
Kernel imports	100 878	1 414	1 257	390 904	400478	330 119	342 721	349 370	586 458	410 462	456 522	526 429	556 543	628 000	537 000	703 000	846 000	690 000
Total availability	753 640	705 225	522 651	927 007	1 169 862	1 199 837	1 569 448	1 510 333	1 856 876	1 725 575	1 943 955	2 081 882	2 426 256	2 183 000	2 217 000	2 220 000	2 246 000	2 050 000
Crushing	0	0	0	0	0	0	0	0	159 318	248 529	217 468	203 833	252 051	140 000	100 000	60 000	0	0
Total use human consumption	753 640	705 225	522 651	927 007	1 169 862	1 199 837	1 569 448	1 510 333	1 697 558	1 477 046	1 726 487	1 878 049	2 174 205	2 043 000	2 117 000	2 160 000	2 246 000	2 050 000
Oilcake production	0	0	0	0	0	0	0	0	127 454	198 823	173 974	163 066	201 641	112 000	80 000	48 000	0	0
Oilcake imports	26 640	199 775	71 769	103 568	206 076	175 223	306 716	257 000	72 323	186 700	5 252	193 348	170 631	499 000	682 000	942 000	986 000	450 000
Oilcake total use	26 640	199 775	71 769	103 568	206 076	175 223	306 716	257 000	199 777	385 523	179 226	356 414	372 272	611 000	762 000	990 000	986 000	450 000
O.T.U. kernel equivalent	33 300	249 719	89 711	129 460	257 595	219 029	383 395	321 250	249 722	481 904	224 033	445 518	465 340	763 750	952 500	1 237 500	1 232 500	562 500
Total imports kernel equivalent	122 190	161 234	58 672	473 758	565 339	470 297	588 094	554 970	644 316	559 822	460 724	681 107	693 048	1 027 200	1 082 600	1 456 600	1 634 800	1 050 000
Total use k. equivalent	786 940	954 944	612 362	1056 467	1 427 457	1 418 866	1 952 843	1 831 583	1 947 280	1 958 950	1 950 520	2 323 567	2 639 545	2 806 750	3 069 500	3 397 500	3 478 500	2 612 500
% human cons./total ut. k. equiv.	96 %	74 %	85 %	88 %	82 %	85 %	80 %	82 %	87 %	75 %	89 %	81 %	82 %	73 %	69 %	64 %	65 %	78 %
% K. imports Human cons	13 %	0 %	0 %	42 %	34 %	28 %	22 %	23 %	25 %	11 %	14 %	17 %	14 %	24 %	21 %	30 %	38 %	34 %
% imports share k. equiv.	16 %	17 %	10 %	45 %	40 %	33 %	30 %	30 %	33 %	29 %	24 %	29 %	26 %	37 %	35 %	43 %	47 %	40 %
Per capita human ut. (Kg)	5,118	4,697	3,414	5.938	7,349	7,392	9,482	8,949	9,864	8,417	9,648	10,292	11,685	10,768	10,942	10,949	11,165	9,994
Oilcake ut per capita (kg)	0,226	1,663	0,586	0,829	1,618	1,349	2,316	1,903	1,451	2,746	1,252	2,442	2,501	4,025	4,923	6,273	6,127	2,742

Source : CBS and US Embassy Jakarta, presented by F.Lançon, CIRAD

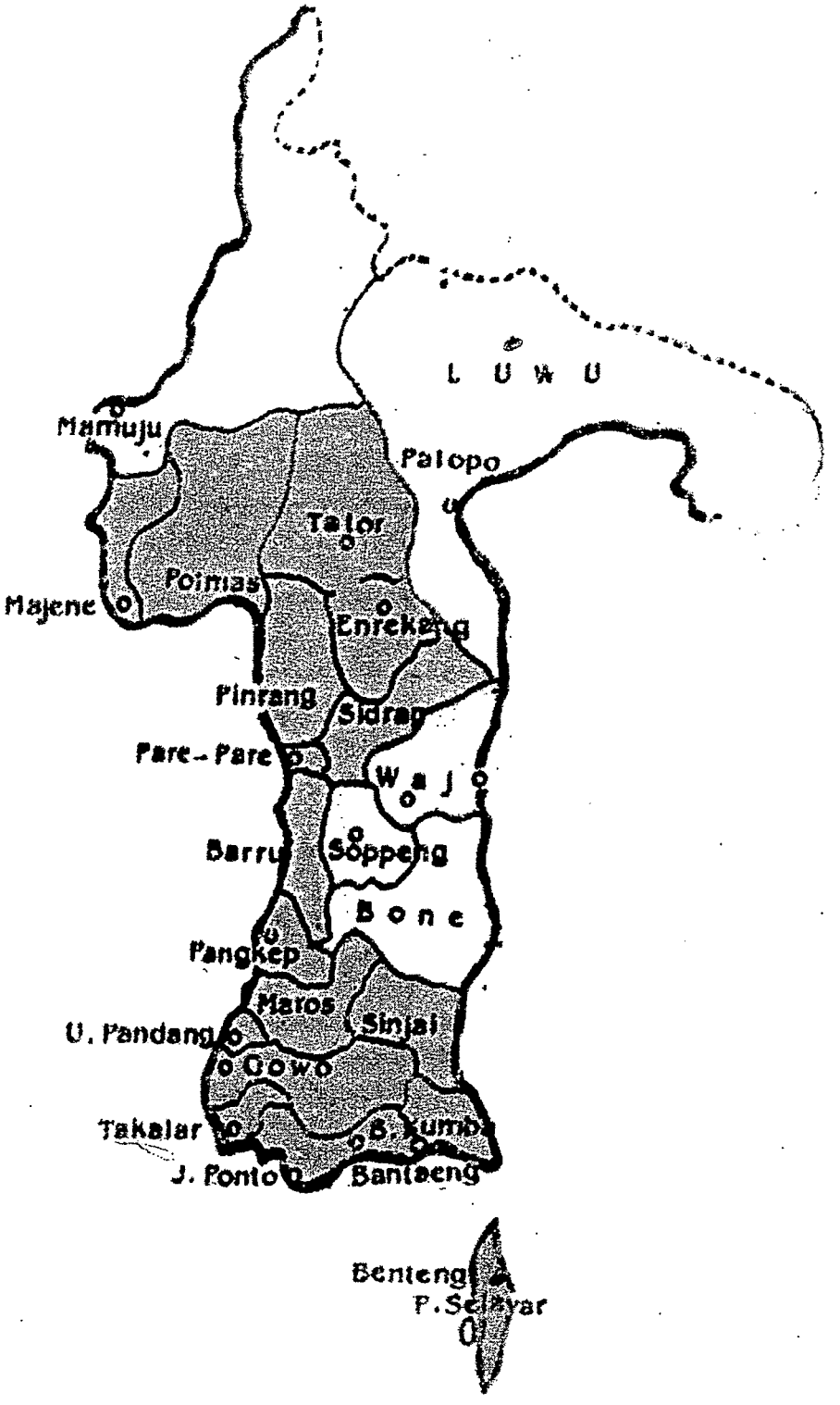
Statistical data : prices (rupiah)

Année		1991	1992	1993	1994	1995	1996	1997	1998
Mean gross price Jakarta Rp/kg	. Soy	1151	1105	1165	1215	1148	1148	1166	2000
	. Rice				868	1248	1013	1017	
	. Maize				459	500	627	576	
Rice producer price Rp/kg		295	330	340	360	400	450	525	600
Urea Rp/kg		210	220	240	260	260	330	400	400
Price index (1998=100)	. Gross price agriculture		225	251	298	355	399	441	
	. Detail price alimentation			136	156	179	189	227	251
	. Detail price total			148	163	177	189	211	226
Mean yearly exchange rate (Rp/USD)				2110	2200	2308	2383	4650	8000
International market price (FOB Rotterdam USD/tonne)	. Soy			246	259	248	304	278	291
	. Oilcake			207	202	184	256	260	258
Relative prices	. Soy/rice				1.40	0.92	1.13	1.15	
	. Soy/maize				2.65	2.30	1.83	2.02	
	. Rice/Urea	1.4	1.5	1.4	1.4	1.5	1.4	1.3	1.5
Index base 100 = 1993	. Soy gross market			100	104	99	99	100	172
	. Gross price agriculture			100	119	141	159	176	
	. Detail price alimentation			100	115	132	139	167	185
	. Detail price total			100	110	120	128	143	153
World market price in Rupiah	. Soy			519	570	572	724	1293	2328
	. Oilcake			437	444	425	610	1209	2064

Note : 1998 = January

Sources : CBS and FAS-USDA, presented by F. Lançon, CIRAD

GERAKAN PENINGKATAN PRODUKSI & EKSPORT KEDELAI (GRATEKS-2)



○ SENTRA PRODUKSI

◎ DILUAR SENTRA

GAMBAR JALUR BENIH ANTAR MUSIM UNTUK KEDELAI PROPINSI SULAWESI SELATAN

BBI (Provincial Seed Farm) I
BS - BD BS → FS.

Batukaropa

II

(Sept - Desember)
September Tanam (Planting)
Desember Panen (Harvesting)
BD-BP pada Obyek

Kab. Bantaeng = 2.000 Ha
Kab. Luwu = 8.000 Ha
Kab. Wajo = 2.000 Ha
Kab. Mamuju = 2.500 Ha
Kab. Soppeng = 9.000 Ha

III

(Januari - Maret)
Planting Tanam : Januari
Harvesting Panen : Maret

Kab. Jeneponto = 1.000 Ha

IV

(April - Juni)
Tanam : April
Panen : Juni

Kab. Takalar 500 Ha
Kab. Gowa (MK.I) = 4.000 Ha
Kab. Maros (MK.I) = 2.000 Ha
Kab. Bulukumba = 1.000 Ha
Kab. Soppeng = 750 Ha
Kab. Pangkep = 2.000 Ha

V

(Juli - September)
Planting Tanam : Juli
Harvesting Panen : Akhir Sept (End of)

Kab. Gowa (MKII) = 2.000 Ha
Kab. Maros (MKII) = 1.000 Ha
Kab. Pangkep = 1.000 Ha
Kab. Sidrap = 4.500 Ha
Kab. Soppeng = 3.300 Ha
Kab. Wajo/Danau = 20.000 Ha
Kab. Luwu = 1.500 Ha
Kab. Mamuju = 2.500 Ha
Kab. Pinrang = 500 Ha

VI

(Nov - Maret)
Planting Tanam : Akhir Nov. (End of)
Harvesting Panen : Akhir Maret (End of March)

Kab. Wajo/T.Hujan = 10.000 Ha
Kab. Bone/T/Hujan = 30.000 Ha
Kab. Luwu = 1.500 Ha
Kab. Bulukumba = 3.000 Ha
Kab. Soppeng = 750 Ha
Kab. Sidrap = 1.500 Ha

VII

Planting
Harvesting

Hasil Sigi Tim Palawija Seed Production and Marketing Project Th. 1995, Tentang Hasil Analisa Laboratorium Benih Kedelai Jabalsim

LAB. ANALYSIS ON SOYBEAN SEED FROM JABALSIM

Kabupaten DISTRICT	Jumlah Sampel NO. OF SAMPLE	Rata - Rata (%) AVERAGE							Musim benih sampel SEASON WHEN THE SAMPLES TO BE TAKEN
		Berkecambah GERMINATE	Berkec. >70% ?	Rusak	Biji Lain OTHER SEED	Kotoran OTHER MATTER	K.a MOISTURE CONTENT	Belang MOZAIC	
Banyuwangi	10	85.2	90	1.49	0.00	1.54	11.60	2.21	MH (RAINY SEASON)
Bojonegoro	11	90.3	100	0.12	0.02	0.40	12.35	0.40	MK-2 (DRY SEASON - 2)
Jember	19	76.3	89	1.18	0.00	0.72	11.48	7.61	MH, MK1, MK2 (RAINY SEASON, DRY SEA - 1, DRY
Jombang	15	86.6	100	3.31	0.04	1.00	10.42	2.29	MH, MK1 (RAINY SEA, DRY SEA, 1
Lumajang	18	79.4	72	1.22	0.06	2.23	12.27	0.75	MK1, MK2
Madiun	6	76.2	83	1.17	0.00	0.62	13.18	0.22	MK1
Nganjuk	20	82.7	90	2.26	0.01	1.29	13.01	1.03	MH, MK2
Ngawi	7	81.9	100	13.06	0.05	3.73	12.11	0.07	MH
Pasuruan	15	85.0	100	2.15	0.01	0.81	10.61	4.44	MH, MK2
Ponorogo	21	87.4	100	1.53	0.02	1.38	11.94	1.86	MH, MK1, MK2
Total Jatim	142	83.3	92	2.21	0.02	1.31	11.38	2.69	

Sumber : Nugraha et al., 1996

c:\123r5\SIGI

Groundnut (in-shell) area, yield and production by region[1].

	Area ('000 ha)			Yield (t ha^{-1})			Production ('000 t)		
	1979-81	1989-91	1994-96	1979-81	1989-91	1994-96	1979-81	1989-91	1994-96
Developing countries	17,793	19,410	21,763	0.9	1.1	1.3	16,523	21,124	28,078
Africa	6,087	5,684	7,923	0.7	0.8	0.8	4,233	4,523	6,401
Eastern and Southern Africa	2,134	1,481	2,011	0.7	0.6	0.7	1,447	824	1,350
Mozambique	350	342	256	0.4	0.3	0.4	131	113	98
Sudan	960	332	972	0.8	0.6	0.8	760	173	756
Tanzania	91	110	113	0.6	0.6	0.6	54	62	72
Uganda	109	185	192	0.7	0.8	0.7	80	149	137
Zimbabwe	183	192	148	0.6	0.6	0.4	101	108	66
Western and Central Africa	3,905	4,159	5,748	0.7	0.9	0.8	2,710	3,613	4,717
Burkina Faso	129	181	261	0.4	0.3	0.8	70	121	215
Chad	168	186	305	0.7	1.1	0.8	93	164	233
Congo, Dem. Rep.	477	628	739	0.7	0.8	0.8	334	520	594
Mali	166	188	204	0.9	1.0	0.9	141	163	180
Nigeria	572	920	1,868	0.9	1.2	0.9	503	1,083	1,770
Senegal	1,053	857	863	0.7	0.9	0.9	690	757	686
North Africa	48	44	70	1.6	1.4	2.3	74	64	161
Egypt	12	13	43	2.1	2.2	2.9	26	27	124
Morocco	28	22	17	1.2	0.9	1.4	34	20	21
Asia	10,887	13,226	13,374	1.0	1.2	1.6	11,134	15,828	20,871
East Asia	2,358	2,960	3,777	1.5	2.1	2.7	3,513	6,104	10,117
China	2,293	2,911	3,770	1.5	2.1	2.7	3,416	6,011	10,103
South Asia	7,707	9,217	8,437	0.8	0.9	1.1	6,483	8,162	9,025
India	7,132	8,562	7,797	0.8	0.9	1.1	5,999	7,570	8,359
Myanmar	489	523	493	0.8	0.9	1.0	390	456	508
Pakistan	49	84	101	1.2	1.1	1.1	60	89	112
Southeast Asia and the Pacific	783	1,009	1,109	1.4	1.5	1.4	1,060	1,466	1,605
Indonesia	496	628	691	1.5	1.7	1.6	754	1,039	1,073
Thailand	103	116	100	1.2	1.4	1.5	128	160	148
Vietnam	106	207	257	0.9	1.1	1.3	94	218	329
West Asia	39	40	51	2.0	2.4	2.4	78	96	124
Syria	10	11	14	1.8	2.0	2.1	18	22	30
Turkey	23	23	31	2.2	2.5	2.4	52	58	73
Latin America and the Caribbean	819	500	466	1.4	1.5	1.7	1,156	773	806
Argentina	289	166	176	1.6	2.1	2.5	451	345	432
Brazil	282	85	89	1.5	1.7	1.8	433	142	162
Mexico	66	87	71	1.1	1.3	0.9	73	110	61
Paraguay	29	36	33	1.0	1.1	1.1	28	39	34
Developed countries	920	913	925	2.2	2.3	2.1	2,011	2,145	1,979
Australia	32	20	20	1.5	1.6	1.7	48	31	33
Bulgaria	4	12	11	1.3	1.0	0.9	6	12	10
Greece	4	2	1	2.8	3.9	3.6	11	7	3
Israel	5	3	4	4.4	6.6	5.9	22	20	24
Japan	33	18	14	1.9	2.0	2.2	61	36	30
South Africa	245	120	118	1.2	1.1	1.3	297	131	158
USA	595	738	609	2.6	2.6	2.8	1,550	1,893	1,719
World	18,713	20,323	22,688	1.0	1.1	1.3	18,534	23,269	30,057

1. Each figure is a 3-year average for the respective period, e.g., 1979-81

Source: FAO

Growth rates (percent per year) of groundnut utilization by type and region, 1979–96.

	Confectionery	Oil	Meal	Per caput food supply
Developing countries	**4.2**	**3.6**	**4.5**	**2.4**
Africa	2.7	4.1	5.4	–0.3
Eastern and Southern Africa	–1.3	–2.2	–1.8	–3.5
Mozambique	–0.6	–0.2	3.0	–2.7
Sudan	–1.2	–4.1	–6.2	–3.8
Tanzania	–0.5	4..9	4.9	–3.7
Uganda	4.1	3.9	4.0	1.3
Zimbabwe	–1.7	7.8	5.0	–4.7
Western and Central Africa	3.6	6.4	7.2	1.0
Burkina Faso	7.3	7.3	7.3	4.5
Congo, Dem. Rep.	4.3	4.2	4.3	0.8
Mali	3.0	2.0	3.0	–0.8
Nigeria	3.4	11.7	11.9	0.4
Senegal	17.4	8.0	21.0	–0.9
North Africa	4.3	3.8	4.9	–6.0
Algeria	0.0	12.2	26.9	–2.0
Morocco	0.0	–2.1	–2.5	–2.0
Asia	5.0	3.6	4.6	1.4
East Asia	6.4	5.5	5.9	2.6
China	6.4	5.8	5.9	4.9
South Asia	2.8	2.9	3.2	–2.4
India	3.0	3.0	3.4	1.2
Myanmar	0.4	1.4	0.2	–1.7
Pakistan	3.6	3.7	3.8	0.0
Southeast Asia and the Pacific	2.6	4.3	13.5	0.6
Indonesia	3.1	4.1	16.8	2.0
Thailand	1.7	0.1	19.7	0.4
Vietnam	3.4	9.3	8.0	0.7
West Asia	4.0	3.3	1.1	2.0
Turkey	3.2	3.6	3.8	1.0
Latin America and the Caribbean	3.3	–3.6	–2.9	2.6
Argentina	11.4	–6.4	–2.2	–2.0
Brazil	5.4	–0.8	–6.3	6.8
Mexico	3.5	5.3	9.0	1.0
Developed countries	**1.2**	**–2.5**	**–5.3**	**0.2**
Europe (EC)	3.4	0.0	–6.3	1.6
South Africa	–4.3	–4.0	0.0	–7.0
USA	0.3	–0.1	6.5	–0.5
World	**3.6**	**2.9**	**2.6**	**1.7**

Source: FAO

Groundnut economy

	Africa	Asia	Europe	Latin America and the Caribbean	Oceania
General information					
1. Estimated population, 1996 (millions)	739	3488	729	484	29
2. Estimated population growth rate, 1994-2010 (% per year)	3.8	2.1	0.5	2.3	na
3. Per caput GNP (US$), 1996	na	na	na	na	na
4. Per caput oilseed production, 1994-96 (kg)	22.5	42.3	45.2	112.6	118.4
5. Per caput groundnut production, 1994-96 (kg)	8.9	6.1	0.0	1.7	1.3
Groundnut statistics					
6. Groundnut area harvested, 1994-96 average ('000 ha)	7957	13,393	12	463	23
7. Groundnut production, 1994-96 average ('000 t)	6386	20,925	14	808	37
8. Groundnut yield, 1994-96 average (t ha^{-1})	0.8	1.6	1.1	1.7	1.6
9. Groundnut share in total oilseed area, 1994-96 (%)	46.5	16.0	0.1	1.8	1.7
10. Groundnut share in total oilseed production, 1994-96 (%)	39.5	14.4	0.0	1.5	1.1
11. Growth rate of gr .ut area, 1977-86 (% per year)	-2.2	1.6	-0.8	-5.5	-0.1
12. Growth rate of groundnut area, 1987-96 (% per year)	3.8	0.8	-0.7	-3.2	-4.5
13. Growth rate of groundnut production, 1977-86 (% per year)	-2.6	4.5	-0.8	-3.6	0.7
14. Growth rate of groundnut production, 1987-96 (% per year)	4.3	4.0	-6.5	-0.8	-1.6
15. Growth rate of groundnut yield, 1977-86 (% per year)	-0.4	2.8	0.1	1.9	0.8
16. Growth rate of groundnut yield, 1987-96 (% per year)	0.5	3.2	-5.9	2.4	2.9

Southeast Asia and the Pacific

	Indonesia	Philippines	Thailand	Vietnam
General information				
1. Estimated population, 1996 (millions)	200	72	60	75
2. Estimated population growth rate, 1994-2010 (% per year)	na	na	2.4	na
3. Per caput GNP (US$), 1996	1080	1160	2960	290
4. Per caput oilseed production, 1994-96 (kg)	81.0	174.4	37.4	21.9
5. Per caput groundnut production, 1994-96 (kg)	5.4	0.5	2.5	4.5
Groundnut statistics				
6. Groundnut area harvested, 1994-96 average ('000 ha)	691	44	100	257
7. Groundnut production, 1994-96 average ('000 t)	1073	36	148	329
8. Groundnut yield, 1994-96 average (t ha^{-1})	1.6	0.8	1.5	1.3
9. Groundnut share in total oilseed area, 1994-96 (%)	14.9	1.4	11.0	40.9
10. Groundnut share in total oilseed production, 1994-96 (%)	6.7	0.3	6.8	20.3
11. Growth rate of groundnut area, 1977-86 (% per year)	0.2	-1.6	3.9	10.7
12. Growth rate of groundnut area, 1987-96 (% per year)	2.2	-2.1	-2.7	1.9
13. Growth rate of groundnut production, 1977-86 (% per year)	3.3	-1.4	5.4	11.5
14. Growth rate of groundnut production, 1987-96 (% per year)	0.9	-1.6	-1.6	5.7
15. Growth rate of groundnut yield, 1977-86 (% per year)	3.1	0.1	1.5	0.8
16. Growth rate of groundnut yield, 1987-96 (% per year)	-1.3	0.5	1.1	3.8

Source: FAO

From "The world Groundnut Economy". ICRISAT 1999

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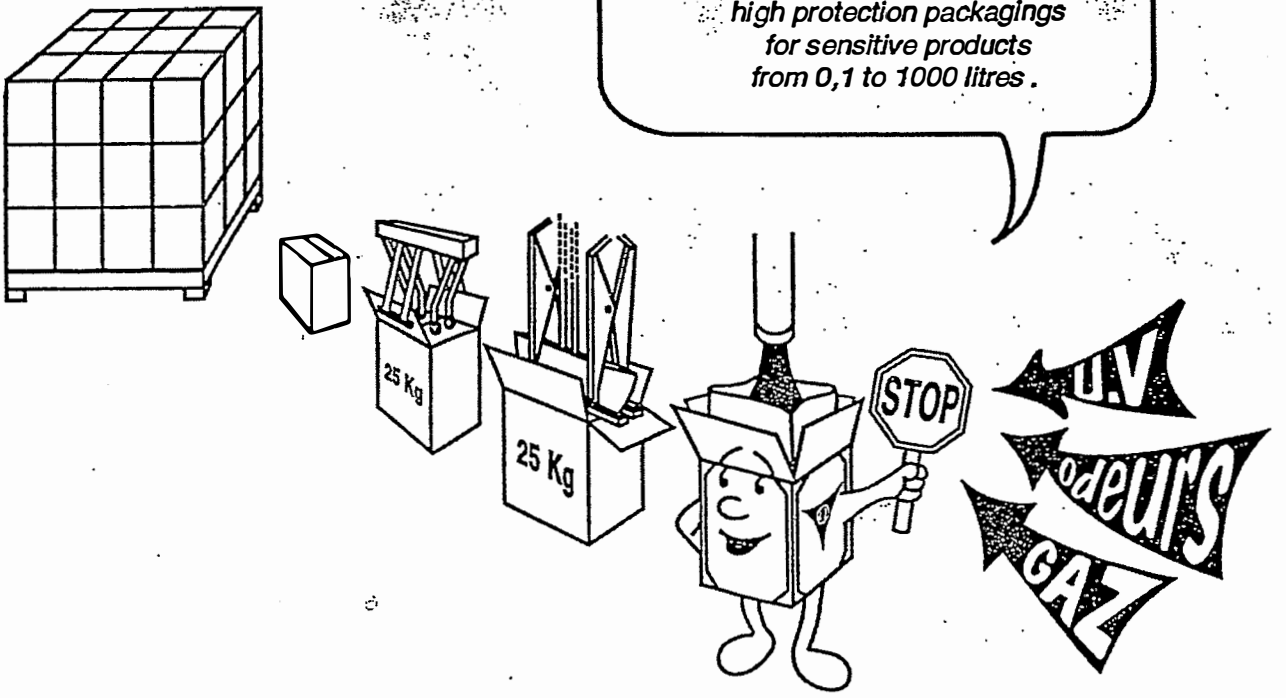

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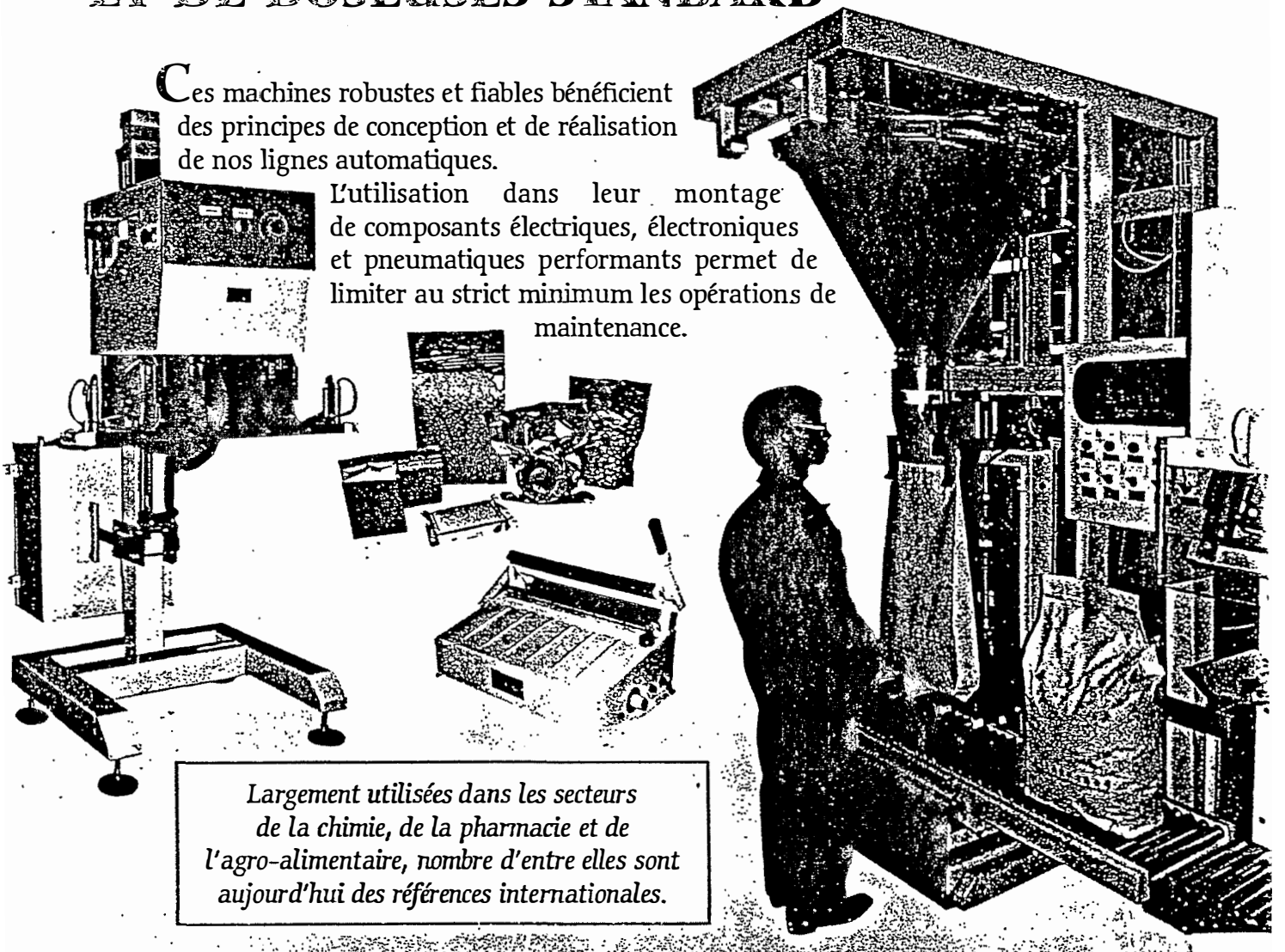


Largement utilisées dans les secteurs de la chimie, de la pharmacie et de l'agro-alimentaire, nombre d'entre elles sont aujourd'hui des références internationales.

bernhardt

Créée en 1956 au cœur du 1er port de pêche français par Joseph BERNHARDT, ingénieur novateur, la société s'est naturellement tournée à l'origine vers le conditionnement des produits de la mer. C'est au début des années 70 que, sous l'impulsion de son PDG actuel, Jacques GOURLET, son activité s'est élargie, en partenariat avec les plus grands groupes internationaux, au conditionnement des produits sensibles nécessitant un emballage «protecteur».

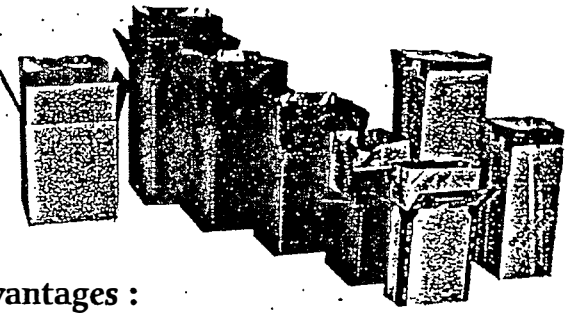
Aujourd'hui, forte d'une expérience acquise tant en France qu'à l'étranger*, la société BERNHARDT s'attache à définir en étroite collaboration avec ses clients la solution emballage-machine la mieux adaptée à leurs contraintes.

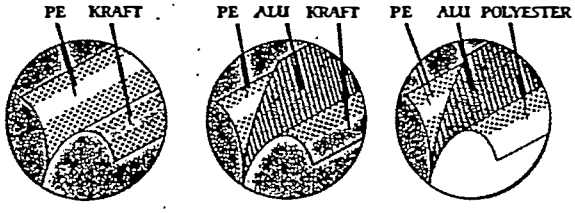
C'est dans cet esprit de PMI où chaque client est un client important que s'inscrit la démarche qualité BERNHARDT concrétisée, tout au long des différentes étapes de réalisation d'une commande, par la rigueur des procédures de contrôle.

* *Les exportations qui représentent plus de la moitié du chiffre d'affaires de la société ont concerné, au cours des cinq dernières années, plus de 40 pays.*

DES EMBALLAGES POUR VOS PRODUITS SENSIBLES

La CMR-Fût, la Caisse-Poche, la DS BOX, les Sacs et Sachets **BERNHARDT** en complexe haute barrière permettent de conditionner les produits les plus sensibles avec la garantie d'une excellente protection.

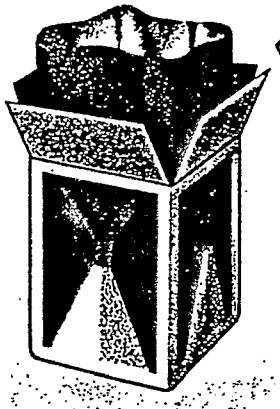


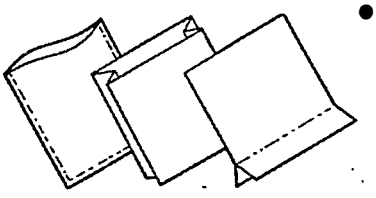


Complexes haute barrière

Principaux avantages :

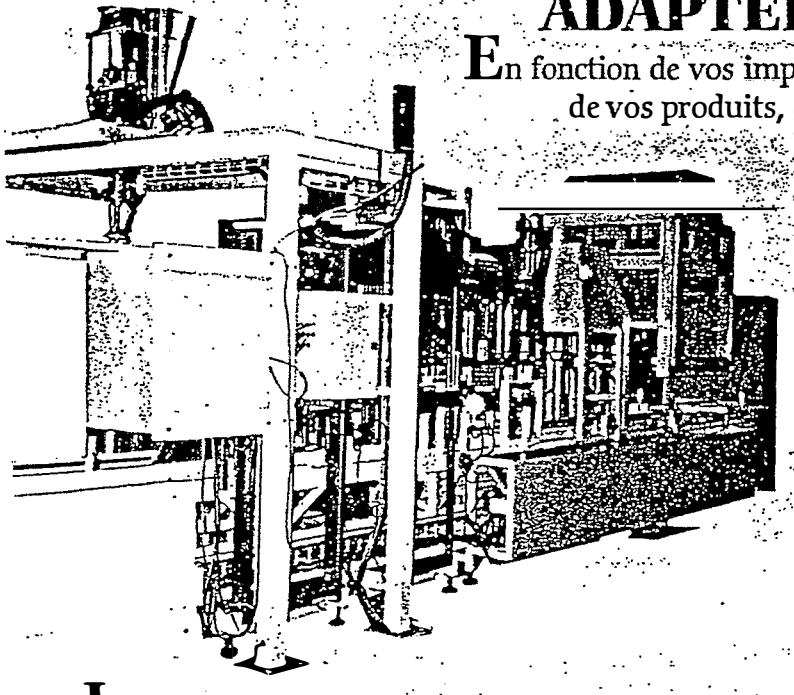
- Stockage réduit des emballages livrés à plat,
- Etanchéité à la vapeur d'eau et à l'oxygène,
- Protection accrue du produit,
- Solution adaptée aux contraintes de l'écologie,
- Rapport qualité-prix emballage/produit exceptionnel.





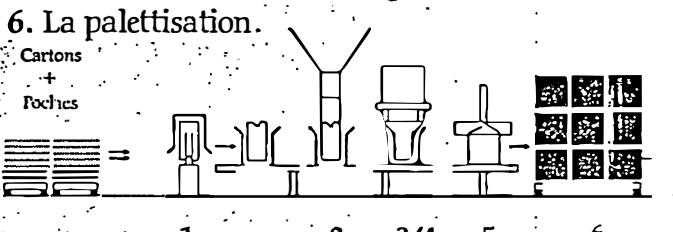
La souplesse de notre outil de production, jumelée à celle de notre concept emballage, nous permet de présenter à nos clients des solutions personnalisées, en petite ou grande série, allant de 0,25 à 2000 litres.

DES CHAINES DE CONDITIONNEMENT ADAPTÉES



En fonction de vos impératifs de production et de la spécificité de vos produits, des solutions entièrement automatisées peuvent être envisagées comprenant :

1. La mise en forme de l'emballage (sac, caisse, caisse-poche...),
2. L'emplissage et le contrôle poids,
3. La mise sous vide ou sous atmosphère modifiée (options),
4. La thermosoudure de la sache,
5. La fermeture des emballages,
6. La palettisation.



Les équipements que nous réalisons sont le fruit d'une démarche technologique innovante, engagée depuis plus de 20 ans par notre société. Grâce à sa souplesse d'adaptation et à sa capacité de mobilisation, BERNHARDT est ainsi à même de répondre, dans son champ de compétences, à vos demandes les plus spécifiques.